THE GEOGRAPHICAL JOURNAL

VOLUME LXXIX

JANUARY TO JUNE

1932

PUBLISHED UNDER THE AUTHORITY OF THE COUNCIL

EDITED BY THE SECRETARY

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CONTENTS

NO. 1 *JANUARY* 1932

EXPLORATIONS IN GARHWAL AROUND KAMET. By F. S. SMYTHE 1

THE SMALL-SCALE MAPS OF THE ORDNANCE SURVEY. By BRIGADIER H. S. L. WINTERBOTHAM, C.M.G., D.S.O., Director-General O.S. 17

THE PURCELL SOURCE OF THE KOOTENAY RIVER. By J. MONROE THORINGTON and EATON CROMWELL 32

JOHN ADAMS AND HIS MAP OF ENGLAND By EDWARD HEAWOOD, Librarian R.G.S. 37

NOTES ON A TRAVERSE OF NORWEGIAN LAPLAND IN 1930. By CHARLES ELTON 44

REVIEWS : *EUROPE :* The Archaeology of Surrey. The Archaeology of Somerset. In the Highlands. How Europe Grew. Die Landschaft des Europäischen Nordens in ihren Übergängen von Deutschland bis Lappland. Risorse Idrauliche per Forza Motrice Utilizzate e Ancora Disponibili. Landeskunde von Deutschland. Greek Cities in Italy and Sicily. *ASIA :* In Bolshevik Siberia. The Imperial Gazetteer of India. The Climate of Japan. Bronnen Tot de Geschiedenis der Oostindische Compagnie in Perzië. *AFRICA :* Nigerian Sketches. Parergon : or Eddies in Equatoria. A Wayfarer in North Africa. The Stone Age Cultures of Kenya Colony. *NORTH AMERICA :* The Great Plains. The Rainbow Canyons. *AUSTRALASIA AND PACIFIC :* Australia and New Zealand, with Pacific Islands and Antarctica. Paradise Quest. *PHYSICAL AND BIOLOGICAL GEOGRAPHY :* Applied Geophysics. The Tidal Force. Principles of Structural Geology. The Study of Rocks. Vergleichende Landschaftskunde. Handbook of Ethnography. *ECONOMIC AND HISTORICAL GEOGRAPHY :* The English Adventurers. Allgemeine Verkehrsgeographie. The Corridors of Time. The Travels of Marco Polo. *GENERAL :* In the Track of the Crusaders. Memoirs of a Soldier of Fortune. The Wander Years 49

THE MONTHLY RECORD : The Proposed Northumberland National Park. Glaciation in the North Sea Region. Changes in the Po Delta. Aluminium Resources of Italy. The Mountains around Tatsienlu. Salt Lakes in East Africa. Adirondack Drainage System. Old Kentucky Documents. The Geography of Daniel Defoe 72

OBITUARY : Colonel Milo Talbot 78

CORRESPONDENCE : The New One-inch Ordnance Map. 'Social and Economic Geography' 79

MEETINGS : Session 1931–1932 80

MAPS :

The approaches to Kamet 2

Glaciers of the Badrinath Range : sketch by Captain E. St. J. Birnie . 7

Sketch-map of the Purcell Range and sources of the Kootenay River . 34

704532

THE BASIN OF THE RIVER PARANA. By W. S. BARCLAY . . 81

DISTRIBUTION OF THE URBAN POPULATION IN GREAT BRITAIN, 1931. By PROFESSOR C. B. FAWCETT, D.SC. . . . 100

RAILWAY DEVELOPMENT IN TANGANYIKA TERRITORY. By BRIGADIER E. M. JACK 117

THE HEAD WATERS OF THE MNYERA RUAHA. By MICHAEL A. UNWIN HEATHCOTE 124

TWO EXPEDITIONS TO SPITSBERGEN, NORTHEAST LAND, AND THE NEIGHBOURING ISLANDS. By CHRISTOPHER T. DALGETY 131

REVIEWS. *EUROPE :* Dartmoor in all its Moods. Das Alpine Europa und Sein Rahmen. Süddeutschland. Wanderings in Greece. Arbeiten der Anstalt für Hessiche Landesforschung an der Universität Giessen. La Porte de Bourgogne et d'Alsace. Die Geographischen Gebiete Finnlands. *ASIA :* The Romance of the Indian Frontiers. The Frontier Peoples of India. India and Jambu Island. *AFRICA :* The Bantu Tribes of South Africa. Monumenta Cartographica Africae et Aegypti. Youssouf Kamal. Rock-Paintings in South Africa. Bushman Art : Rock Paintings of South-West Africa. *NORTH AMERICA :* A Canadian Geologist. *CENTRAL AND SOUTH AMERICA :* Modern South America. *AUSTRALASIA AND PACIFIC :* South Australia. The Island Builders of the Pacific. *PHYSICAL AND BIOLOGICAL GEOGRAPHY :* Probleme der Wasserwellen. Handbuch der Klimatologie in fünf Bänden. Glacial Geology and Geographic Conditions of the Lower Mohawk Valley. Grundriss der Tropischen und Subtropischen Bodenkunde. *ECONOMIC AND HISTORICAL GEOGRAPHY :* Gallieni. Markets of London . . . 135

THE MONTHLY RECORD : The Society : Changes in the Bye-Laws relating to Entrance Fees on Election. The Shackleton Memorial. Films of Geographical Interest. Christmas Lectures to Young People. Glacial Features of Wharfedale. Cloudbursts in Westmoreland. European Mountain Populations. An Atlantic–Mediterranean Ship Canal. Railways in Europe, 1830–1848 . . . 153

CORRESPONDENCE : Kamet 159

MEETINGS : Session 1931–1932 160

MAPS :

Sketch-map of the Parana and Paraguay 82
Distribution of Conurbations, 1931 102
Changes in Urban Population, 1921–31 106
Changes in County Population, 1921–31 108
Proposed railways in Tanganyika Territory 118
Head Waters of the Mnyera Ruaha and neighbourhood, from Mr. Heathcote's Survey . . . . . *following* 160

SPEECHES AT THE UNVEILING OF THE SHACKLETON MEMORIAL 161

THE VOYAGE OF THE R.R.S. *DISCOVERY II*: SURVEYS AND SOUNDINGS. By DR. STANLEY KEMP, SC.D., F.R.S. . . 168

THE BASIN OF THE RIVER PARANA, *continued*. By W. S. BARCLAY 186

TIDAL OBSERVATION ON THE GREAT BARRIER REEF EXPEDITION. By MICHAEL SPENDER 201

OLD RIVER-BEDS IN THE FENLANDS. By MAJOR GORDON FOWLER 210

THE ORTHOGRAPHICAL RELIEF METHOD OF REPRESENTING HILL FEATURES ON A TOPOGRAPHICAL MAP. By PROFESSOR TANAKA KITIRÔ 213

A SUBMARINE TROUGH NEAR THE STRAIT OF GIBRALTAR. By PROFESSOR J. W. GREGORY 219

REVIEWS. *EUROPE*: Regional Planning Report on Oxfordshire. The Geography of London River. A Cotswold Book. Russian Waters. Beiträge zur Geologie der Westlichen Mediterrangebiete. Poluostrov Kanin [The Kanin Peninsula]. Dänemark, Schweden, Norwegen. Wanderings. Summer Islands. And then to Transylvania. The Wandering Gentile's Log Book (1929–1931). *ASIA*: A Passport to China. Lou-Lan. Under Eastern Roofs. Plant Hunting in the Wilds. The Soul of Malaya. Les Noms des Lieux Habités par les Chinois en Mandchourie. In the Arabian Desert. The Stormswept Roof of Asia. Voiceless India. *AFRICA*: L'Algérie. Shooting with Rifle and Camera. The Lambas of Northern Rhodesia. Mémorial du Service Géographique de l'Armée. *NORTH AMERICA*: Canada's Western Arctic. *CENTRAL AND SOUTH AMERICA*: A Naturalist in Brazil. Länderkunde Südamerikas. *AUSTRALASIA AND PACIFIC*: Growing up in New Guinea. The Psychology of a Primitive People. *POLAR REGIONS*: Cold. *PHYSICAL AND BIOLOGICAL GEOGRAPHY*: The Surface-History of the Earth. Physics of the Earth—II. The Figure of the Earth. Emigration, Migration and Nomadism. *CARTOGRAPHY*: Land Forms and Life. Tacheometric Tables. *ECONOMIC AND HISTORICAL GEOGRAPHY*: Narratives from Purchas his Pilgrimes. Viaggio del Beato Odorico da Pordenone. Histoire Générale de la Navigation du XV^e^ au XX^e^ Siècle. History of Palestine. *GENERAL*: Sailing the World's Edge. By Cargo Boat and Mountain . . . 221

THE MONTHLY RECORD: Banks and Channels of the Thames Estuary. The Source of the Garonne. Survey of Berlin. Population of France, 1801–1926. The Glaciers of Kilimanjaro. Retreat of the Muir Glacier, Alaska. The Bartlett Trough, West Indies. Limits of the Australian Desert. Old Pictures of Chinese Cities. Bibliographie Géographique 1930 246

OBITUARY: John Story Masterman 252

CORRESPONDENCE: Glaciation and Continental Drift . . 252

MEETINGS: Session 1931–1932 256

MAPS:

The South Sandwich Islands 172

General Map of the Falkland Islands and Dependencies . . . 178

Sketch-map of Guayra Falls 190

Submarine Trough near the Strait of Gibraltar 220

Surveys and Soundings of the R.R.S. *Discovery II*, 1929–30, *following* 256

A JOURNEY TO THE GLACIERS OF THE EASTERN KARAKORAM. By PROFESSOR GIOTTO DAINELLI 257

THE LAKES OF KENYA AND UGANDA. By DR. E. B. WORTHINGTON, M.A., PH.D. 275

THE LÖTSCHENTAL: A REGIONAL STUDY. By PROFESSOR J. F. UNSTEAD 298

THE LIVINGSTONE-STANLEY MEMORIALS IN AFRICA. By CAPTAIN C. H. B. GRANT 318

NEW TIDAL CHARTS FOR BRITISH WATERS. By DR. A. T. DOODSON and R. H. CORKAN, B.SC. 321

ZIMBABWE: Review by H. J. BRAUNHOLTZ 323

REVIEWS. *EUROPE:* St. Leonard's Church and the Ancient Town of Hythe. Southampton: A Civic Survey. Belgium and Luxemburg. A Journal of My Journey to Paris in the Year 1765. Thorpe's Yachtsman's Guide to the Dutch Waterways. Länderkunde der Niederlande und Belgiens. Der Rhein. *ASIA:* Survey of India: Geodetic Reports. A Refuge from Civilization, and Other Trifles. A Wanderer in Indo-China. Arabia Felix. Siamese State Ceremonies. *AFRICA:* The African Republic of Liberia. The African Handbook and Traveller's Guide. *NORTH AMERICA:* Freshwater. *CENTRAL AND SOUTH AMERICA:* Ancient Civilizations of the Andes. *AUSTRALASIA AND PACIFIC:* Great Dipper to Southern Cross. *POLAR REGIONS:* South Georgia: the British Empire's Subantarctic Outpost. *CARTOGRAPHY:* An Introduction to the Mathematics of Map Projections. *ECONOMIC AND HISTORICAL GEOGRAPHY:* Regional Survey and its Relation to Stocktaking of the Agricultural and Forest Resources of the British Empire. *GENERAL:* The Approach to Geography 326

THE MONTHLY RECORD. Visit of the King and Queen. Foreign Secretary. The Strait of Anian. The First Ascent of Mount Fairweather. The Volcanic Origin of the Bermudas. Fall of Sea-level in the Malay Archipelago. The Climate of Kerguelen Island. Names on the Antarctic Chart. Ice Formation on Unfrozen Surfaces. Early Advice to Travellers 342

OBITUARY: Sir Maurice de Bunsen 348

CORRESPONDENCE: A Submarine Trough off the Coast of Cyprus. Roddons 349

MEETINGS: Session 1931–1932 352

MAPS:
Natural Divisions of the Lötschental 302
Tidal Chart for the English and Bristol Channels 320
Tidal Chart for the Irish Channel 322
Glaciers of the Eastern Karakoram . . . . . *following* 352
Lakes of Kenya and Uganda . . . . . *following* 352

THE BRITISH ARCTIC AIR ROUTE EXPEDITION. By H. G. WATKINS 353

A FOURTH JOURNEY IN THE TIEN SHAN. By LIEUT.-COL. REGINALD C. F. SCHOMBERG, D.S.O. 368

THE NEW PHOTOGRAPHIC SURVEY OF SWITZERLAND. By MICHAEL SPENDER 383

SOME FURTHER TRACES OF THE FRANKLIN RETREAT. By WILLIAM GIBSON 402

THE POLAR FRONT. By A. R. H. 409

ARABIA FELIX: Review by W. H. LEE WARNER 410

IRISH POLITICAL GEOGRAPHY: Review by E. L. 415

REVIEWS. *EUROPE:* The Place-Names of Galloway. Scottish Place-Names. Place-Names of Glengarry and Glenquoich and their Associations. L'Agriculture en Roumanie. An Agricultural Atlas of Scotland. Economic Geography of Europe. La Franche Comté. Die Nachfolgestaaten: Österreich, Ungarn, Tschechoslowakei und ihre wirtschaftlichen Kräfte. Dalmatia: The New Riviera. At the Western Gate of Italy. *ASIA:* An English Lady in Chinese Turkestan. Trails to Inmost Asia. A Geography of Ceylon. *AFRICA:* Mission de Prospection des Forces Hydrauliques de l'Afrique Équatoriale Française. Historic Farms of South Africa. The Birds of Tropical West Africa. *CENTRAL AND SOUTH AMERICA:* Archives of British Honduras. *AUSTRALASIA AND PACIFIC:* Memories of Pioneer Days in Queensland. *POLAR REGIONS:* The South Sandwich Islands. *PHYSICAL AND BIOLOGICAL GEOGRAPHY:* Bulletin of the National Research Council. *CARTOGRAPHY:* Internationales Archiv für Photogrammetrie (Archiv International de Photogrammétrie). *ECONOMIC AND HISTORICAL GEOGRAPHY:* Histoire de l'Extrême-Orient. Japan. A Primer of Economic Geography. The Kensington Stone. Rome and the Romans. *GENERAL:* Collected Essays of Naomasa Yamasaki. The Northern Lands. Water Diviners and their Methods. Geography and Stamps . 419

THE MONTHLY RECORD. Medals and Awards, 1932. The Reports of Colonel Fawcett. Geography in the Universities. Glacier-Lakes in Cumberland. The Danish Eskers. A Century of Ice-Observation in Davis Strait. The Issiq Köl. Journey to the Hukong Valley, 1890. Floods in East Africa, 1930. Population of Canada, 1931. East Greenland. A New Settlement on the Parana. The Homem Charts of the Sixteenth Century 441

CORRESPONDENCE: Island Arcs and Mountain Building . . 447

MEETINGS: Session 1931–1932 448

MAPS:

Proposed British Arctic Air Route 354

Sketch-map to illustrate Col. Schomberg's fourth journey in the Tien Shan 369

Col. Schomberg's route through the Central South Tien Shan . . 372

Sketch-map of the vicinity of Simpson Strait, from Admiralty Chart No. 5101 403

Southern Greenland, showing the seven journeys of the British Arctic Air Route Expedition . . . . . *following* 448

The Base Fjord, British Arctic Air Route Expedition, from a survey by A. Stephenson . . . . . *following* 448

THE CORAL COASTS OF INDIA. By LIEUT.-COL. R. B. SEYMOUR SEWELL, SC.D. 449

THE BRITISH ARCTIC AIR ROUTE EXPEDITION, *continued*. By H. G. WATKINS 466

BY AIR MAIL TO KENYA. By MICHAEL A. UNWIN HEATHCOTE . 502

THE *GAUSS* ANTARCTIC REPORTS : Review by H. R. M. . 506

REVIEWS. *EUROPE :* Tramping through Wales in search of the Red Dragon. The Adventure of the Faeroe Islands. Daniel Vetter a jeho " Islandia." Slovakia Then and Now. France : a regional and economic geography. *AFRICA :* Cape to Cowley *via* Cairo in a Light Car. Historical Outline and Analysis of the Work of the Survey Department of Kenya Colony, 1 April 1903 to 30 September 1929. The Nile Basin. A Game Warden among his Charges. *NORTH AMERICA :* Stream Sculpture on the Atlantic Slope. *AUSTRALASIA AND PACIFIC :* Hunting Insects in the South Seas. Down Under : an Australian Odyssey. The Lost Continent of Mu. The Children of Mu. Across New Guinea from the Fly to the Sepik. *POLAR REGIONS :* The *Marion* Expedition to Davis Strait and Baffin Bay, 1928. *PHYSICAL AND BIOLOGICAL GEOGRAPHY :* Ergebnisse der Kosmischen Physik. Manual of Meteorology. The Age of Pithecanthropus. *CARTOGRAPHY :* An Account of the Primary Triangulation of Malaya, together with the Secondary Chain through Kelantan and Secondary Points on Penang Island. *ECONOMIC AND HISTORICAL GEOGRAPHY :* The Court-Martial of the *Bounty* Mutineers. A History of Geographical Discovery and Exploration. London in Mittelalter. Les Caractères Originaux de l'Histoire Rurale Française. A Short History of British Expansion. History of Palestine and Syria, to the Macedonian Conquest. The Disaster of Darien. Europe and China. Histoire de la Nation Egyptienne. *GENERAL :* The Book of the Sailing-Ship 509

THE MONTHLY RECORD. Seventy-fifth Anniversary of the Geographical Society of Vienna. The Geographical Society of Belgrade. Portrait of Charles Enderby. Research in Eastern Siberian Waters. Last Spanish Expedition on North-West American Coast, 1793. Geodetic Survey of Canada. The " Gente Hermosa " Island of Quiros. The Four-metre Sounding Tube of the *Snellius* Expedition. Relative Terms for Geographical Position. The Jungfraujoch Scientific Station. Harmonic Tidal Constants for Durban 536

CORRESPONDENCE : Glaciation and Continental Drift 542

MEETINGS : Session 1931–1932 544

MAPS :
Coral Reefs of India 450
Kangerdlugsuak . . . . . *following* 544
East Coast of Greenland, from Ikersuak to Umivik Bay . *following* 544

The
GEOGRAPHICAL JOURNAL

Vol LXXIX No 1 R.G.S. *January 1932*

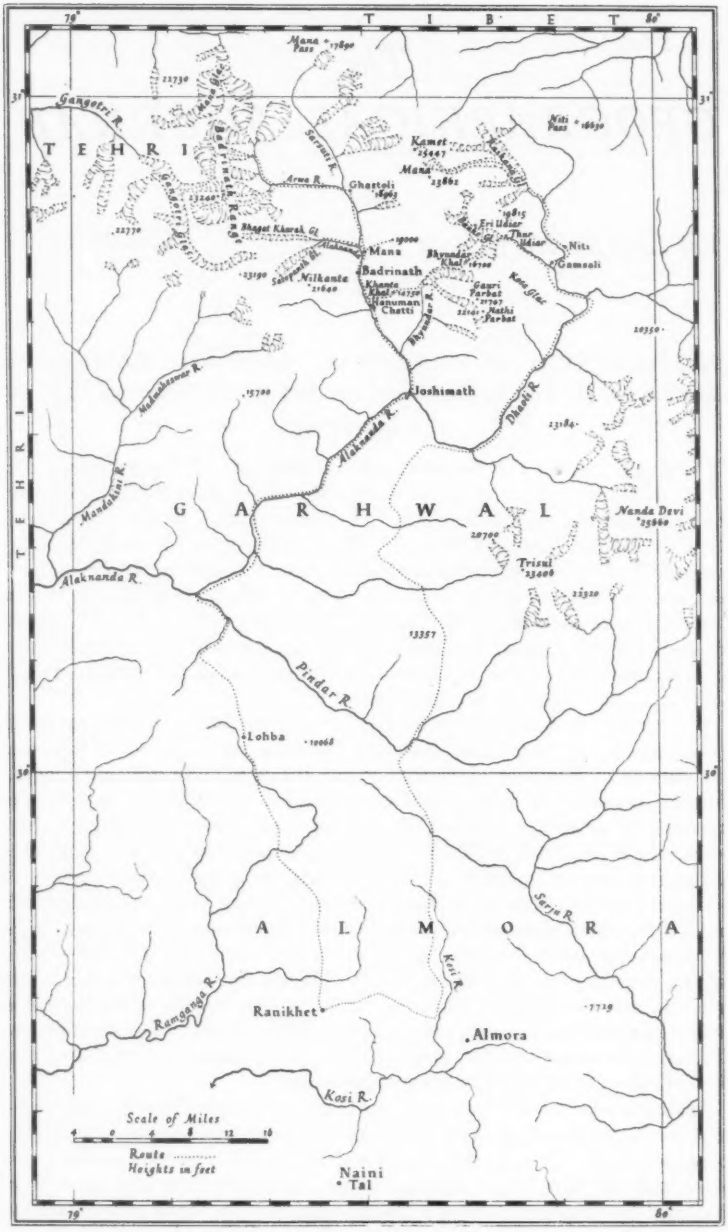
EXPLORATIONS IN GARHWAL AROUND KAMET: *A paper read at the Evening Meeting of the Society on 2 November 1931, by*

F. S. SMYTHE

THE personnel of the Kamet expedition consisted of Wing-Commander E. B. Beauman, R.A.F.; Captain E. St. J. Birnie, Adjutant to His Excellency the Governor of Bengal's Bodyguard, Transport Officer to the Expedition; Dr. C. R. Greene, Medical Officer; Mr. R. L. Holdsworth, Mr. E. E. Shipton, and myself. The expedition had two main objects: the ascent of Kamet, 25,447 feet, and explorations in the Badrinath Range, to the west of Kamet, which forms the watershed of the Alaknanda and Gangotri rivers, the two parent tributaries of the Ganges. As a description of the ascent of Kamet would have more mountaineering than topographical interest, I propose to deal here only with the second object of the expedition.

It is strange that Garhwal should be so seldom visited by explorers and mountaineers, for but ten days' marching suffices to take the traveller from the hill stations of Ranikhet or Almora to the fringe of little-explored ranges. Further, the explorer in Garhwal experiences a delightful climate; severe snowstorms are almost unknown during the summer months on the higher peaks, whilst the foothills relieve the monsoon clouds of much of their moisture, so that it is possible to climb in comfort during the height of the monsoon in northern Garhwal. The main Himalayan chain, which includes Nanda Devi and Trisul, should however be avoided during this season. The farther north the traveller proceeds the better is the weather. At Badrinath it is said only to rain for a week or ten days, whilst near the Tibetan frontier fine weather is the rule, and only the strongest bursts of the monsoon penetrate to the northern end of the Badrinath range and the Mana Pass. Another factor enters to diminish the strength of the monsoon in northern Garhwal, and that is the shearing effect of the dry Tibetan westerly winds.

Apart from the excellence of its climate Garhwal is unparalleled in my experience for its combination of fertile beauty and wild grandeur. As Dr. T. G. Longstaff wrote: "It is almost the only part of the Himalaya that can be compared with the Alps." It is indeed, like the Alps, built on a huge scale; it is inhabited by people professing a Hindu religion in its lower valleys and by nomadic Bhotias in its upper valleys whose religion alternates between



The approaches to Kamet

Hinduism and Buddhism according to which side of the Tibetan frontier they happen to find themselves. An additional charm is lent to Garhwal by the association of its peaks and glaciers with Hindu mysticism, mythology, and religion. Its two principal rivers, the Dhaoli which drains the glaciers to the east of Kamet and the Alaknanda which drains the glaciers to the west of Kamet and those on the eastern side of the Badrinath range, unite to form the Ganges. The Alaknanda is regarded by Hindus as actually forming the source of the Ganges, and, because of this, some 50,000 pilgrims flock annually to Badrinath to pay their respects to the snows whence issue the waters of that river which they believe to be associated with Siva and Vishnu. It was of these snows that the Hindu scribe wrote:

"He who thinks of Himachal [the Himalayan snows], though he should not behold him, is greater than he who performs all worship in Kashi [Benares]. And he who thinks on Himachal shall have pardon for all sins; and all things that die on Himachal, and all things that in dying think of his snows, are freed from sin. In a hundred ages of the Gods I could not tell thee of the glories of Himachal, where Siva lived and where the Ganges falls from the foot of Vishnu like the slender thread of a lotus flower."

What mapping has been so far accomplished of the Badrinath Range, while giving a fair idea of general directions, is not in keeping with the other excellent work done by both Indian and European surveyors in Garhwal. The Gangotri glacier, about 25 miles long, appears never to have been visited since an enterprising officer of "The Company" trod its lower portion over a hundred years ago. It is however only fair to add that I have not at my disposal the records of the Indian Survey dealing with this district. In 1913 however Mr. C. F. Meade visited the Bhagat Kharak and Satopanth glaciers. Had he had more time at his disposal he might have forced a pass from the former glacier over the watershed of the Alaknanda and Gangotri rivers to the Gangotri glacier, thereby accomplishing the first crossing of this range. The Bhagat Kharak and Satopanth glaciers form the joint source of the Alaknanda river.

After descending from Kamet we arrived at a camping ground near the village of Gamsali in the Dhaoli Valley, where we rested two days to enable us to recoup our energies after a somewhat strenuous time at high altitudes, reorganize our porterage, and make arrangements for sending our Sirdar Lewa, who had been seriously frostbitten on Kamet, to the hospital at Joshimath. As regards porterage it is perhaps interesting to note that one of the objects of the expedition was to cut down the number of porters to the minimum in order that the expedition could live on the country. This was achieved by excluding rigorously unessentials as far as possible. Actually, we never employed more than seventy porters, and these included nine men carrying unessentials in the form of cinematographic and photographic apparatus.

En route to Gamsali considerable difficulty in crossing the Dhaoli river above Niti was experienced, and for the benefit of other Himalayan travellers it may be of interest to mention the method by which this formidable glacier torrent was crossed. In this particular instance it was possible for a man to cross higher up, but as this involved some rock climbing it was deemed advisable to get the loads across at a point lower down. In the case where it is not easily

possible to get a single man across a torrent a point must be found where the torrent curves sharply, so that the first man with a rope tied to him can be lowered down the torrent to the opposite bank. Having got a man across, a rope was fixed between large boulders. A strong V-shaped juniper root was next found. This was placed inverted over the rope and from it suspended loops of rope in which was placed the load or man. This contrivance was then pulled across the stream, the juniper offering but little frictional resistance. It was in fact a primitive form of the rope and breeches buoy by means of which shipwrecked mariners are rescued.

The vanguard of the monsoon arrived at Gamsali simultaneously with ourselves, but it was a mild, desultory affair, for the bulk of its moisture had been precipitated on the ranges of southern Garhwal and Kumaun. Indeed, the natives at Gamsali told us that they seldom experience more than a few days of bad weather, even during the height of the monsoon season.

Our next object was to force, if possible, a new pass over the range south of Kamet and between the Kamet massif and the peaks of Gauri and Hathi Parbat. Both the Meade and Longstaff expeditions had traversed the Bhyundar, 16,700 feet, and Khanta Khal, 14,750 feet, passes which had been traversed as long ago as 1862 by Colonel Edmund Smyth. The late Mr. Arnold Mumm, who was a member of Dr. Longstaff's expedition, had however noticed indications of a pass from the head of the Banke glacier system which, if practicable, would lead down to the Alaknanda valley above Mana. We decided therefore to follow this information up, and in addition see whether the Mana Peak was accessible from this side.

Leaving Gamsali on July 5 with only light luggage (the heavy luggage was sent round by the lower route *via* Joshimath to Mana) we ascended the Banke valley to the alp known as Thur Udiar, which is just below the snout of moraine-covered Banke glacier. The following day we pushed on to Dr. Longstaff's camping ground at Eri Udiar (Cold Cave). On July 7 Holdsworth and Shipton attempted to climb a fine rock and ice-peak 19,815 feet high, rising directly above Eri Udiar. They were unsuccessful, and had to retreat owing to lack of time 300 feet from the top. The following day Shipton and a Darjeeling porter, Nima, returned to the attack. This time Shipton was successful and was able to enjoy an excellent view of the upper part of the Banke glacier. The same day that this was accomplished Beauman and Greene explored the head of the Banke glacier. The topography of the Banke glacier, its tributary glaciers and neighbouring ridges, did not correspond to the map, so they made a rough sketch-map by means of photographs and prismatic compass bearings. Unfortunately there was no possibility of forcing a pass over the range, for the head of the Banke glacier is enclosed by a ridge, the face of which is excessively steep and plastered in hanging glaciers. The locality was also decidedly dangerous owing to the great ice and snow avalanches that the warm monsoon airs were peeling from every mountain-side. There did not appear either any possibility of climbing the Mana Peak from this direction; its southern ridge is very long and both difficult and dangerous to approach, whilst its south-eastern face is quite impracticable. Thus we were forced to cross the easy passes previously mentioned, and descend into the Alaknanda valley at Hanuman Chatti. Yet if no pioneering work was possible we were rewarded in other

Bhyundar valley

Looking down Glacier 6 from 19,500-foot peak, climbed 18 July 1931

ways. The Bhyundar valley, along the upper part of which we had to pass, is richer in flora than any Alpine valley I have ever seen. The hillsides were snowy with anemones, like the narcissus fields about the Lake of Geneva. There were countless potentillas, yellow nomicharis, kingcups with single and double flowers, the beautiful blue Himalayan poppy, geraniums of two kinds, forget-me-nots, pale blue borage, mauve polemonium, crimson orchids, rosy-coloured cypripedium, dwarf larkspur, and clumps of great purple asters. Holdsworth, our botanist, discovered no fewer than ten varieties of Alpine primula, among which were the tiny stemlets of *primula reptans* and *primula denticulata*, *primula involuceata*, and *primula androsace*. Peaks unnamed and unclimbed stand watch and ward over this Eden, greatest among them Gauri Parbat, the Brilliant mountain, to the north of which we noted a well-defined gap which, if practicable, would lead over the range to the Kosa glacier. Dr. Longstaff was told by the natives that there was no practicable route down the Bhyundar valley to its confluence with the Alaknanda valley above Joshimath, but now there is a good path, frequently used by shepherds and their flocks. For us however it was more convenient to traverse the Khanta Khal Pass, 14,750 feet. This route, since it was traversed by Dr. Longstaff, has now fallen into disuse, and we experienced some difficulty in descending into the Alaknanda valley owing to the dense vegetation through which we had to force our way.

At Hanuman Chatti we found ourselves on the pilgrim route to Badrinath, a route strongly impregnated with the odour of sanctity. At Badrinath we were received by the High Priest, the Rawal Sahib, and garlanded with flowers. Much interest was shown over our ascent of Kamet, and we were asked whether we had seen England from the top. This was not the first time we had been asked this question, and as an instance of how a tradition may originate it is perhaps interesting to mention that when Dr. Longstaff climbed Trisul in 1907 the Gurkha soldier, Karbir, who accompanied him and his guides to the summit, was asked, on their descent, by the villagers what view they had seen. Being of a somewhat inventive turn of mind the Gurkha replied with grave face that he had made out the city of Bareilly and, beyond that, Bombay and the Black Water (the ocean), and beyond that, Wilayat (England), and he knew it was England because he had been there. Thus it has come about that all the villagers in northern Garhwal now believe that one has only to climb a high mountain in order to see England from the top. Another curious tradition was that on the summit of Kamet is a palace of pure gold tenanted by a powerful god.

We arrived at Mana on July 12, being greeted by the whole village with the village band and the local idol. Mana is a Bhotia village, whereas the inhabitants of Badrinath, which is but 2 miles away, are Hindus. The Bhotias enjoy a smoke by the simple expedient of digging two small holes in the ground, boring a tunnel between them, filling one hole with tobacco, lighting it, and sucking energetically at the other hole. At Mana, also, we witnessed the blessing of the sheep before being sent up to the upper pastures, a ceremony accompanied by much drum beating. Two days were spent in resting and reorganizing our transport. The Gamsali and Niti men were dismissed and Mana Bhotias recruited in their stead. In our main object, which was the

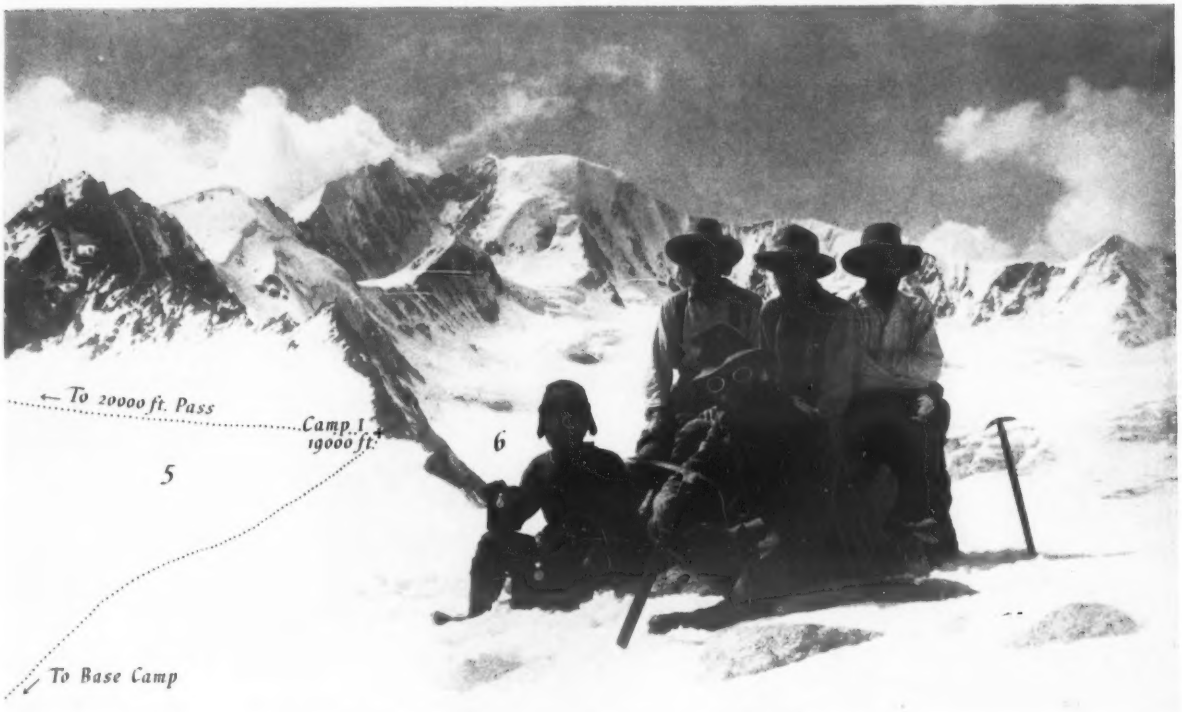
Looking down Glacier 6 from 19,500-foot peak, climbed 18 July 1931

crossing of the Badrinath range, there were two possibilities. We might ascend the Alaknanda valley and the Bhagat Kharak glacier and force a pass across the range from the head of the glacier; the second possibility was to ascend the Arwa valley, which is the next valley to the north of the Alaknanda valley and runs parallel to it. The sketchy manner in which this valley and its surrounding ridges is delineated on the map suggested that little or nothing was known about it. Its most important feature appeared to be a glacier about 12 miles long, which filled it to within 3 miles of its junction with the main Sarsuti valley, which leads up from Badrinath and Mana to the Mana Pass and Tibet. The only information we could obtain about the Arwa valley was that one Piggott or Biggott had visited it about thirty years previously. Also its lower portions are used for grazing the village flocks.

On July 15 we left Mana and marched up the Sarsuti valley, following the trade route to the Niti Pass as far as Ghastoli. Next day we entered the mouth of the Arwa valley and found ourselves on grassy slopes gay with yellow and red potentillas and other flowers. Two miles from its junction with the Sarsuti valley the Arwa valley is almost blocked by a great terminal moraine. This, at first sight, appears to be the terminal moraine of a main glacier filling the valley. Actually however it is the terminal moraine of a side glacier debouching from the south into the valley. Traversing beneath this moraine was a risky business, as boulders were constantly falling from the snout of the glacier, hundreds of feet above. Having passed it we were not surprised to find that the 12-mile-long glacier marked on the map was non-existent and that the valley continued for another 6 miles without a glacier. The fact that on the eastern side of the Sarsuti valley there is a measured point of 18,963 feet opposite the Arwa valley suggests that the native surveyors, instead of ascending the Arwa valley, merely observed it from this point, and looking up it not unnaturally mistook this terminal moraine for the terminal moraine of a glacier filling the upper portion of the valley. This side glacier appears to be advancing. An advance of only 200 yards would suffice to dam the Arwa river, and as the valley is almost flat for 3 miles above this terminal moraine a dam might result in the formation of a large lake. Should the dam afterwards burst, disaster would overtake villages in the Alaknanda valley. The progress of this side glacier should be carefully observed.

We camped at about 14,000 feet near the highest juniper bushes. Next day we continued on up the valley, noting as we did so three glaciers of considerable size debouching into the valley from the south. Camp was pitched near the point where the main Arwa valley forks into two glacier-filled valleys. The branch (2)running in a south-westerly direction contains much rock coloured by iron; the branch running in a north-westerly direction branches into three glaciers (4, 5, and 6) of considerable size which themselves branch off into other glaciers. In the map the frontier of British Garhwal and Tehri Garhwal is marked as running along the range north of the Arwa valley in an east-south-east west-north-west direction. In reality however there is no main ridge at all, but a confused jumble of ranges and glaciers. As our principal object was to cross the watershed and descend to the Gangotri glacier, it was our first duty to discover which of the many ridges before us formed the actual watershed. The Base Camp was pitched at about 16,000 feet. On the

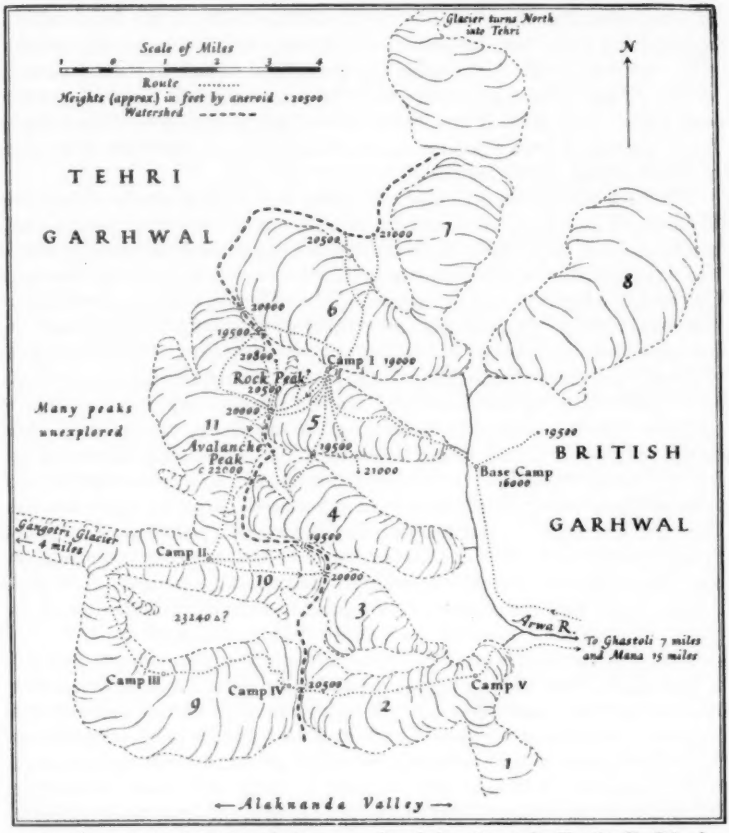
Looking west from 19,500-foot peak, climbed July 18; Avalanche Peak to left



Summit of 19,000-foot peak, Arwa valley, climbed July 19

next day, July 18, Greene, Shipton, and I climbed a peak of 19,500* feet to the north-east of the camp in order to obtain a better view of the complicated district and return if possible knowing the direction of the watershed.

We were well climatized and ascended at a rate of 1500 feet an hour. We reached the summit without difficulty. So delightfully warm was it that we spent many pleasant hours there. Although we were able to observe a con-



Glaciers of the Badrinath Range: sketch by Captain E. St. J. Birnie

siderable portion of the complicated glacier system at the head of the Arwa valley it was still not possible to determine which of the many ridges before us constituted the watershed. The most promising line of exploration lay up a glacier (5) running up in a westerly direction from our camp. Running up in a north-easterly direction and coming into the valley just above our camp was a

*Heights given were determined by aneroid and are open to considerable correction; if anything I believe they are under-estimated.

Summit of 19,000-foot peak, Arwa valley, climbed July 19

glacier (8) quite 5 miles long, whilst a direct continuation of the valley in which our camp was pitched opened out into a vast snowfield (6), the ridge at the head of which might well prove to be the watershed ridge. We were evidently on the border-line of the area influenced by the monsoon and the area swept by the dry westerly Tibetan winds, and it was interesting to watch the moisture-charged clouds blown up from the south pouring over the ridges and meeting annihilation from the dry westerly winds. So well defined is this line of wind shear that the snow-line on the southern side of the Arwa valley is considerably lower and the glaciers considerably larger than on the northern side, showing that the Arwa valley forms a natural funnel for the dry westerly winds. I have seldom spent a happier day on a mountain top, and so warm was it that it was actually possible to sit in one's shirt sleeves. Many magnificent mountains from 20,000 to 23,000 feet high rose to the south of us, some of which appear totally inaccessible.

The same day that we ascended the 19,500-foot peak, Beauman, Birnie, and Holdsworth ascended the glacier (5) running up in a westerly direction to a height of about 19,000 feet, where they discovered an excellent camping site on a rock ridge separating this glacier from the great snowfield (6) we had observed. On the following day, July 19, we ascended to this site, climbing on the way a minor peak of about 19,000 feet from which we enjoyed a beautiful view and were able to observe distinct indications of a pass at the head of the glacier (5) on which our new camp (I) was pitched. On July 20, Birnie, Holdsworth, Shipton, and myself walked up the glacier and climbed a short, steep, but easy slope to the pass. Arriving on the ridge we found to our satisfaction that we were indeed on the watershed. Before us and separated from us by a steep slope only 300 feet high was a large glacier (11), running downwards in a south-westerly direction and then curving round out of sight in a westerly direction to join the main Gangotri ice-stream. It was decided that Birnie and a porter should descend to this glacier and endeavour to force their way back over the watershed by a pass which had been previously noted by Holdsworth, a pass which, if practicable, would lead them back into the great snowfield (6) north-west of our camp. Shipton and I meanwhile climbed a peak of 20,800 feet on the watershed ridge to the north-west of our pass. Unfortunately however we were able to obtain but a poor view owing to mist and snow squalls, but we were able to observe the finest peak we saw in the Badrinath range with the exception of Nilkanta—an extraordinary fang-like peak of snow and ice which rises from the ridge forming the westerly retaining wall of the glacier (11) leading downwards to the Gangotri ice-stream. We returned to camp in a heavy snowstorm, feeling somewhat anxious about Birnie, but he, with excellent mountaineering judgment, traversed his proposed pass, descended into the snowfield (6) north-west of the camp, and from it climbed up to the ridge on which was pitched the 19,000-foot camp.

Opposite to our camp and on the far side of the glacier (5) rose the finest peak in the vicinity, about 22,000 feet high.* This Shipton and I attempted to climb on July 21, but were forced to retreat by a snowstorm. The following day we returned to the attack; this time we were successful after a steep climb up snow slopes and an ice ridge. Birnie and a porter followed us the same day.

*Subsequently named Avalanche Peak.

Unfortunately, owing to mists we saw little or nothing from the top, but we obtained glimpses of what appeared to be another feasible pass across the range immediately to the south of us, which links up the glacier (10) leading down into the Gangotri glacier and glacier 4. Immediately to the south-west of this pass rose what we took to be the only triangulated peak of any magnitude in the northern end of the Badrinath range, 23,240 feet high. It is however not quite certain whether there are not higher peaks. The beautifully formed snow and ice peak we had previously noted must be at least 23,000 feet high. The descent was marred by the only mountaineering accident of the expedition. When glissading the last snow slope to the glacier I was overwhelmed by an avalanche dislodged by a companion above me and carried down over the bergschrund, with the result that I fractured a rib and was severely bruised about the body.

The following day, July 24, a snowstorm prevented any work from being done. It was now decided that in order to carry out the maximum amount of exploration and mountaineering in the limited time at our disposal we should split up into three parties. Holdsworth and Shipton were to remain at the 19,000-foot camp and continue with the exploration of the glaciers in the immediate vicinity. Beauman and Greene were to descend to Mana and ascend the Alaknanda valley and note any possibility of passes existing from the head of the Bhagat Kharak glacier to the head of the Gangotri glacier or from the head of the Satopanth glacier to the Madmaheswar valley which drains into the Mandakini river. Birnie and I were to cross the watershed by the pass originally discovered, descend to the Gangotri glacier and endeavour to force a pass back over the watershed into the Alaknanda glacier system, preferably linking up to Beauman and Greene. This scheme depended for its success largely upon good visibility, and doubtful weather would entail retreat for a party lightly provisioned and far from its base. Unfortunately however I was forced to return before the pass had been gained, as my bruised thorax, by preventing full expansion of the lungs, did not allow of sufficient oxygen being imbibed. I was carried down in a fainting condition, but soon revived on gaining a lower altitude and was able to accompany Beauman and Greene down to Mana. Despite the snowstorm, Birnie with eight porters crossed the pass, descended some 3 or 4 miles down the glacier (11) on the eastern side and made his camp (II) not far from the junction of this glacier with the main Gangotri ice-stream.

Doubtful weather rendered the original scheme inoperative, and Birnie decided to keep near enough to the 19,000-foot camp to retreat to it should really bad weather supervene. Next day he ascended a glacier (10) leading up to an apparent pass to the north-east of the 23,240-foot peak and reconnoitred the pass, reaching the base of a very steep slope. The pass was forced up snow slopes. Descent on the far side was found to be possible but difficult, and as the pass led back into the Arwa valley and not to the Alaknanda, as he hoped, he returned. From the pass a view of several miles was obtained down the main Gangotri ice-stream. Birnie then ascended another glacier (9) leading back towards the watershed and partially reconnoitred an obvious pass at its head. Camp III was made at about 17,500 feet.

On the following day reconnoitring was continued with Gian Singh, a local

porter. After some step cutting this second pass was reached. Descent on the far side was found to be steep but practicable. Unfortunately however the pass did not lead to the Bhagat Kharak glacier as hoped, but back to a subsidiary glacier flowing into the Arwa valley. The route over this pass is liable to be overwhelmed by ice avalanches, but a safe camping site (Camp IV) was found. On the next day Birnie with the whole of his porters returned to the pass. The porters were lowered one by one through a cornice and 2000 feet of very steep snow slopes was descended by the party. After a careful descent however the easier glacier (2) was reached. Luckily there was no ice to give trouble. This pass would be possible for laden men only under good conditions, as ascent or descent on the Badrinath side of the watershed would involve too great a strain. Camp V was made at 16,700 feet. The local men showed up exceptionally well and several of them became skilled in handling the ropes and ice-axe. After a long, tedious march Birnie found himself once more in the Arwa valley on July 29, and descended to Mana. Holdsworth and Shipton on July 25 descended to the glacier (6) north of the 19,000-foot camp, and crossed it to a fine peak at the junction of two glacier bays. This they climbed by the south-east ridge, finding the rock very loose. Mist unfortunately spoiled the view from the summit. The peak is about 21,000 feet. They were however able to observe that a glacier about 12 miles long, marked on the map as flowing from east to west, north of the Arwa valley and approximately parallel to it, and draining into the Gangotri glacier, just about its termination, does not exist, its place being taken by another great glacier running not east and west but north and south, which appeared to drain into Tibet. This was an interesting discovery, and, if their brief observation were correct, the ridge separating the Mana glacier from the glacier flowing into the Gangotri glacier does not exist either. It is interesting to note that the frontier of British Garhwal and Tehri Garhwal is marked as running along the crest of the ridge, north of the Arwa valley and parallel to it, but it must bend considerably in a north-westerly direction if it is to follow the main watershed ridge.

On July 26 in good weather the party assailed a peak south-east of the 19,000-foot camp, about 20,400 feet high. An excellent view was enjoyed from the summit, particularly of the great 23,240-foot peak to the south, which from this side appears entirely impracticable. On July 27 another peak of about 21,500 feet was climbed south-east of the camp. On the following day the party descended to Mana, reaching the village on July 29. On July 30 Shipton and four porters ascended the eastern side of the Alaknanda valley, and next day climbed a peak of about 19,000 feet, whence they obtained a good view of the unexplored glaciers south-west of the Mana peak. He returned to Mana the same day. On July 28 Greene and I ascended the Alaknanda valley, intending to explore to the Satopanth glacier, and see if there was any possible pass at its head. Our project was cut short by an accident whereby one of our porters nearly lost his life in a glacier torrent—an accident which entailed the loss of our food. We were however able to visit the combined snout of the Satopanth and Bhaghat Kharak glaciers whence issues the Alaknanda river, considered by Hindus to be the source of the Ganges. It is perhaps a district worthy of the reverence which inspires thousands of Hindus who yearly make

Pass over Badriwath Range; Avalanche Peak to left

Looking up Alaknanda valley to head of Satopanth and Bhagat Kharak glaciers

a pilgrimage to Badrinath. Finest of all the peaks that guard these sacred snows is Nilkanta, a sheer pile of snow and ice, rivalling Siniolchum in its grandeur and beauty. On July 31 the expedition assembled at Badrinath and returned *via* the pilgrim route and Lohba to Ranikhet, which we reached on August 13.

It is not easy to understand why the Badrinath district is so little visited by explorers and mountaineers. Its climate is ideally suited for prolonged work and it is always possible to escape the monsoon to a large extent by keeping well to the north near the Tibetan frontier. In spite of a considerable amount of ground covered in the short time at our disposal we did little more than touch on the vast and complicated glacier system at the northern end of the Badrinath range. The Gangotri glacier, which is probably the greatest glacier in the Central Himalaya, still remains almost completely unexplored, while the peaks around it, and those of the watershed and in the immediate vicinity of Badrinath, are many of them climbable by mountaineers. Undoubtedly, when this district comes to be opened up, it will be recognized as one of the most beautiful and interesting in the Himalaya. Its flower-covered pastures and its magnificent peaks and glaciers demand a return visit.

DISCUSSION

Before the paper the PRESIDENT (Admiral Sir WILLIAM GOODENOUGH) said: The pleasure that we all experienced twelve months ago in meeting for the first time in our own hall is more than doubled when to-night we come home to it. And in that intimacy there are one or two things which Fellows of the Society will wish to know of and which I will ask our guests to bear with for a moment at the opening of the Session. There are eighty-eight proposals for new Fellowship. That is a very good number. But what is not mentioned on the proposal paper is the number that we have lost both by death and by resignation. We have to mourn the loss of such men as Sir Alexander Cobbe, who had just been appointed to the Council; of Major Chipp, who at Kew managed to combine his work there with geographical work; and of the President of the Manchester Geographical Society, Lord Stanley. There have been a large number of resignations, and I ventured to write a letter to each of the Fellows concerned suggesting that they might care to reconsider their decision or postpone it for a few years at any rate. The new buildings—the Map Room, the Library, and this Hall—have to be kept up, and they afford very great amenities to all Fellows. I think many would agree that the range of the Library is in itself comparatively cheap at the subscription of £3 a year, and in the Map Room and other parts of the House there is an immense amount of interest and pleasure to be obtained. And, most important of all, we want a very large amount of support if we wish to keep our place pre-eminent among the other nations and Geographical Societies of the world. There is one addition which we are about to make. We arranged this afternoon to buy a new projector for cinema work. No Geographical Society would be worthy of its name unless it could show films of geographical work. We propose to exhibit such geographical films on some of the spare Mondays; attendance, at any rate for the present, will be confined to Fellows. I hope that will be an additional incentive to people to come and join us.

If Mr. Smythe were not, considering his age, a fairly old Fellow of this Society I should apologize to him for having kept him so long on the platform without drawing the bolt; but as he is a Fellow I need make no apology to him at all. Mr.

Smythe is a mountaineer of many years' experience in Switzerland, and now he is an experienced mountaineer on the Himalaya. He was a member of Professor Dyrenfurth's expedition to Kangchenjunga, and he has made a most successful attack on Kamet, followed by some very admirable work round those portions of the Himalaya known as the Sacred Sources of the Ganges. He may perhaps speak to us rather from the point of view of geographical or, to be more accurate, topographical work than of mountaineering, but I am glad to hear from him that you will not be disappointed if you care for great peaks, for he has a few slides to show of Mount Kamet itself. These he will show you in the lecture which I now ask him to deliver.

Mr. Smythe then delivered the lecture printed above, and a discussion followed.

Mr. HOLDSWORTH: Perhaps Mr. Smythe has left unsaid one or two things I might say. We had a number of attempts on Kamet by previous expeditions to go by, and I think one of the reasons why the international expedition to Kangchenjunga failed was that the leader of that expedition entirely neglected the experience that had been gained by other Kangchenjunga and Mount Everest expeditions. I think that the success of our expedition in climbing Kamet was largely due to the very careful study that Frank Smythe and Bentley Beauman had given to the actual problem of Kamet and the reasons why the other expeditions had failed.

Meade was the first to discover the col which goes by his name between Kamet and the Eastern Abigamin. He went up there with Frank Lochmatter, but he went as quickly as he possibly could, the theory in those days being that the longer one stayed on a mountain above 20,000 feet the worse one felt, and that one's best chance was to do it quickly. The result was that at 23,500 feet he and this extraordinarily strong and capable Swiss guide were practically knocked out and could not move a step farther up the heavy and exhausting snow at that great height. The next expedition, the Kellas and Morshead expedition, decided to attempt acclimatization and did what we did. They went up in stages, remaining two or three days at various useful heights, and when they got to Meade's Col they were comparatively fit; but their trouble was that their transport had broken down badly owing to the lack of proper organization and lack of knowledge about the fuel difficulty. Our expedition had to thank Frank Smythe for getting over both those difficulties. We profited by the lesson learned from Meade, and we went up in slow time, spending, I think, four days at Camp II (18,400 feet) and about five days at Camp III (20,500 feet). We realized the difficulty of fuel some time before and had thought about it in considerable detail. Captain Birnie was an admirable transport officer and was able to get the last ounce out of the porters, both those who came from Darjeeling and those who came from the Central Himalaya. He had a sort of instinct for knowing when they had a legitimate "grouse" and when they were trying something on. On the whole, they are extraordinarily good people and did very well; but he was amazingly good in his grasp of the detail and the efficient way he dealt with the fuel problem. We could afford to equip with proper Alpine equipment only a certain number, I think six, of the local porters, our own ten Sherpas from Darjeeling, and two Gurkha N.C.O.s we took with us. We therefore could not make any unequipped people sleep on snow, so those who were unequipped used to sleep at Camp I, 16,500 feet, or at the Base Camp at 15,500 feet, and make themselves useful while we were climbing the mountain and working the way out by bringing up fuel and food. Juniper, which is the main source of fuel, comes to an end about where the glacier ends. It grows quite plentifully on the terminal moraine. We got juniper scrub carried by means of relays up to 20,500

feet to Camp III, so we did not have to use our spirit fuel except for Camp IV and Camp V. Another reason for not using it earlier was that we found paraffin alone would not burn in a Primus stove. That was what Morshead and Kellas discovered. A mixture of paraffin and petrol would do for a Primus. We had that, and we had Meta, and the result was that when we came down from the day's working out of the route or climbing Kamet, we could get a cup of hot tea as soon as we asked for it.

Compared with the second part of the expedition, Kamet, I felt, was more like trench warfare: a very well organized battle on preconceived lines. The whole way was known. We had to avoid mistakes that had been made by our predecessors and to keep ourselves fit. Otherwise, as far as I was concerned, it was merely a question of going where I was told. The second part of the expedition I think I really enjoyed more because it was in completely unknown country. One ought, I think, to be sympathetic to the Survey of India. Their map, of course, was inaccurate, but, considering the difficulties they had to contend with, and considering the enormous complexity of the Himalaya, to produce a map of such accuracy as they have done is really a prodigious achievement. At the same time, the map being inaccurate one had all the joy of the unknown. One never knew what one was going to see over the next ridge. I remember after we had gone 2 or 3 miles up the Arwa valley we saw it blocked by the great snout of a glacier. I was carrying my skis in the hope of putting them on when I got on to the top of the snout of the glacier, but to my great disappointment I found the glacier petered out and turned out to be one coming in from the side. About 3 miles farther on we found the valley was blocked by another glacier snout, and again I took my skis off my shoulder and said, "The hard work of walking over boulders is over: I shall now walk nicely up gentle snow-slopes." But not a bit of it, for that was also a side glacier.

What interested me most was the view I had from the last peak you saw on the screen. As Mr. Smythe said, he and Birnie were to go over the Gangotri, but Smythe, unfortunately, had to return owing to his crushed rib hurting him so much. So Shipton and I were left, and altogether we had eight days at 19,000 feet. As we had been eight weeks climbing and acclimatizing it was not at all distressing. We had fairly good appetites and slept pretty well. We climbed three mountains there in our last three days. We thought, as Birnie was going towards the south, our duty was to try to discover something on the north. A 21,000-foot peak presented itself towards the north-west of the lower glacier. We crossed the glacier and climbed up a ridge, but unfortunately, although the morning had dawned fair, it was typical monsoon weather, and woolly clouds came up and, most irritatingly, they just came round our heads as we got to the top. Instead of seeing a wonderful view to the north we could only secure the somewhat disquieting information that we were standing on a rather dangerous cornice. But we did get just a glimpse, and we saw that the glaciers at our feet and slightly to the west, instead of continuing to go west into the Gangotri, seemed to turn north. The next day was beautifully fine, and we thought we would try a peak south of our camp, so we climbed a 20,400-foot peak—quite a nice little climb with one or two enjoyable bits of rock-climbing in it, but from there the complexity of the ridges was so terrific that, although it was a beautifully clear day, we simply could not make any contribution to the topographical puzzle.

On the third and last day we sent our goods and chattels down to the Base Camp at 16,000 and dropped to the lower glacier again, crossed it and climbed a 21,500-foot peak. That was a very enjoyable climb with 200 or 300 feet of quite exciting snow on top of ice near the summit. We had the desired view north, and from there we saw Kamet due east and, north-east, we saw the Mana Pass.

I was talking just now to Dr. Longstaff and was relieved to hear confirmed the impression I got. It was very difficult to find where the actual pass was. There seemed to be a glacier flowing both ways, both into Tibet and down into India, which, according to Dr. Longstaff, is exactly what the state of things is on the Mana Pass. But most sensational of all, west of the Mana Pass and over a subsidiary ridge going north and south, there was a very impressive glacier rising in our peak and flowing north into the brown plains of Tibet, which of course is entirely different from what the map says. The map says that there was a big glacier flowing east and west, where the map marks the frontiers of the little local state of Tehri Garhwal. If what we have described is true, the Rajah of Tehri Garhwal will find himself either credited or debited with several thousand more square miles of ice and snow.

The PRESIDENT: You have heard the name of Dr. Longstaff more than once this evening, and not only this evening. I invite him to come on the platform.

Dr. T. G. LONGSTAFF: It is twenty-six years since I was first in the country of which we have heard this evening. To see these photographs and hear Mr. Smythe's lecture has been an immense pleasure to me. He has told us very little of the chief feat which his party performed, the ascent of Kamet, 25,000 feet: 1000 feet higher than Smythe's own record on the Jonsong Peak. Kamet is now the highest mountain that has been climbed to the top, though actually greater altitudes have been reached on Mount Everest. Not only that, but his party displayed the most extraordinary energy in climbing. They seemed to make nothing of climbing a 20,000-footer on any spare Saturday afternoon: they bagged about ten! I want to assure Mr. Smythe and all the members of the party that every mountaineer has the highest respect for their achievement and for the way in which they overcame difficulties without any loss of life: which means that the skill displayed was adequate. One of the fascinations of mountaineering is that if the skill displayed is not adequate you do not come back.

Now what I am going to say now is not a reflection on anything that the speakers have said, but I want to point out that the conditions now are different from what they used to be. The criticism of the Survey of India map is due to a misunderstanding: that survey was made in the seventies. It cannot be compared to the work done by the Indian Survey at the present time. I very carefully read up before I went to that part of the world the literature of the country from 1800 onwards, and I looked up the old Survey Reports. I found that the surveyors were definitely ordered not to waste time on uninhabited districts. They were to map the inhabited valleys and the villages. The old triangulation is reliable, but this map is not a topographical survey at all. It was a question of expense. They were definitely told that in uninhabited hill country they were to spend as little time as possible, and they were simply to sketch in what they could quickly see, without visiting the glacier regions. So those maps are really not comparable in any way with modern work; and they never claimed to be topographical surveys in the modern sense of the word.

Then there is one other thing I wish to say: that our predecessors in those countries, like Sir Richard and Henry Strachey in the fifties and sixties, Edmund Smythe, Drummond, and Webber of the Forest Department, and so on, even to later expeditions than that, found that the local men had the greatest terror of going into those snow regions inhabited by gods and demons. You have to go very slow with those people. If the earlier explorers had tried to force them to go with them up on to the glaciers there would have been difficulties for subsequent travellers. Bruce, Slingsby, Meade, Kellas, and others did not, as a matter of fact, force the local people; they were particularly careful when taking natives

into any place of real difficulty or danger. That policy is now bearing fruit and that policy has rendered it easier for explorers who have come afterwards to get the local men to accompany them. Fear and distrust have gradually worn off: conditions are certainly a little different now as compared with twenty-five years ago.

You heard Mr. Holdsworth express his preference for the joys of exploration, as compared with actual mountaineering. Anybody who has been to that country understands very well something of that. But the audience perhaps do not, because on no occasion has Mr. Smythe made the faintest allusion to the perfectly ghastly and horrible discomfort of mere existence, much less climbing, above 23,000 feet. Those of us who have been there will also emphasize the great achievement of Captain Birnie, who not only organized victory by accomplishing the supply problem without a hitch and without friction with the inhabitants, but himself achieved the ascent of Kamet.

The PRESIDENT: We have with us to-night the Vice-President of the Alpine Club—it is quite possible that people may know his name even better in other connections—and I will ask him to say a word or two: Mr. Amery.

The Rt. Hon. L. S. AMERY, M.P.: I am not sure in what capacity you have asked me to speak, Sir. If it is as a Member of Parliament, then I think my place would be more fittingly occupied by one of those whose majorities have reached Himalayan figures. My majority of not quite 15,000 belongs more properly to an Alpine classification. But perhaps it is—though you may not be aware of the fact, Mr. President—that I am, I think, the earliest explorer still in the ranks of the living of the particular region we have been hearing about to-night. I went all the way up the Alaknanda to its source in the year 1875. I admit when I say "went" I do not mean on my feet. I was eighteen months old and was carried, and on one occasion, owing to a stumble on the part of one of the bearers, I was jerked out of the litter and saved from ending my life in the Alaknanda by being caught by my petticoat and thrown back again. But the object of our expedition—I will not say my object—was, in fact, to do some of that survey work which Mr. Smythe and Mr. Holdsworth have criticized and which I am glad to say Dr. Longstaff has since so brilliantly vindicated. Therefore, no filial piety on my part is required to justify such sketchy work as my father's party did up there in the early seventies.

Like every one else I have been immensely interested in the account of an expedition which did two things. First it set out in the most businesslike fashion to climb the highest mountain yet climbed to its summit. It was all clearly thought out and all done absolutely to time-table and without a single hitch. And then, having done the work, the boys indulged in a little play and scrambled up and down a dozen or so little 20,000-foot peaks and, incidentally, disentangled a certain amount of very complicated country for the benefit of topography at large, leaving the suggestion to others that there is still plenty to disentangle and plenty of fun in the way of jolly little afternoon walks. The scale of these things is always changing. We have only to read the awful doubts that beset the early parties that attempted Mont Blanc: whether it was possible for human beings to exist at heights over 12,000 feet, and all the complicated precautions taken. We think of the immense difficulties that faced the early Himalayan explorers. But now we have these lads waltzing on foot and on ski, and I suppose later on some form of light motor craft, up everything below 22,000 feet. After that even they would allow that serious climbing begins. Up to that they pick anemones and other beautiful flowers. They stroll up the summits with skis under their arms, slide down in graceful loops and curves and, modestly, say hardly anything about it when they come back. Anyhow they have shown that the world

is still full of lots of quite pleasant peaks and bypaths and opportunities for adventure.

The PRESIDENT: May I start by answering the last speaker? Mr. Amery asked in what capacity I asked him to come on the platform. I asked him as one who is a very great friend of the Society whom we are always glad to see here.

It is my most agreeable duty to thank the lecturer on your behalf and on behalf of the Society. That I do with great sincerity. Not only, Mr. Smythe, have you afforded us a most agreeable and interesting evening, but you have shown that there are problems which either yourself or other people will be able to solve in the future. Of the many true things that you have said I think the truest was when you said, "I am sorry I cannot show anything of this properly without a map." This afternoon the Council set up a small Committee with the particular object of improving the mapping of mountains, glaciers, and the like, and those who are interested in such things will have an opportunity of seeing the maps which we shortly hope to produce.

Dr. Longstaff and Mr. Amery have saved me from making any defence of the Survey of India; not that I hold any commission for them any more than for anybody else. But the map which Mr. Smythe spoke of is dated 1880, and you have heard of various reasons why, perhaps, it is not very great in detail. It is agreeable to find that despite his criticisms Mr. Smythe has left the maps which he has made in the hands of the Survey of India to complete. I think he is very wise to have done so.

What we thank Mr. Smythe for, as well as for the very interesting topographical work which he has shown us, is the astonishing beauty of some of his pictures. Anything more lovely than that picture taken by moonlight I do not think we have ever seen in this hall, and I know there is one present who may be considered to be a critic of beauty, the President of the Royal Academy. He told me just before we came here that that was what he was looking forward to, something beautiful. I am sure he is not disappointed. Will you therefore, Mr. Smythe, accept our most grateful thanks for the admirable lecture that you have given us and also accept our congratulations on having accomplished a great feat largely thanks to excellent forethought and organization?

THE SMALL-SCALE MAPS OF THE ORDNANCE SURVEY:

A paper read at the Afternoon Meeting of the Society on 9 November 1931, by

BRIGADIER H. S. L. WINTERBOTHAM, C.M.G., D.S.O.,
Director-General O.S.

IT is natural that we should, occasionally, take stock of our national cartography, and equally natural that it should be in the hall of this Society. The discussion which follows is then only one of a series. The immediate forerunners are the paper by Colonel W. J. Johnston in December 1919, a joint paper on national grids of March 1924, Captain Withycombe on lettering in November 1928, and Mr. Hinks's note in the *Journal* on the new 1-inch in October of this year.

In 1919 Colonel Johnston spoke of the early history of the engraved 1-inch. That history need not be repeated. There are one or two points of interest however which he did not mention. The first "county" sheets with their heavy woods and unsatisfactory hachures, "Mudge's Maps" we might call them, were evidently kept up to date more than we are able to do to-day, and published no doubt in very small numbers. There is a series of five successive sheets of this first map round Brighton, each successive print showing further extensions and new railway construction. On the earliest of these maps the margins were engraved round the outside of the County only. Interior margins were stuck on separately. Contours did not appear until the third edition, and as the spot heights were not very legible it really is difficult to read and to appreciate the country on these early efforts.

Colonel Johnston mentioned that when the time came for the revision of the small-sheet series it was decided to separate the hachures from the detail and water. Hachures should not alter, detail must, and the hachures as long as they were on the same plate would certainly suffer in the process. Thereafter hill features were printed in brown. It is a delightful map, that small engraved sheet with its beautifully clear detail and hills. Separation from the detail was then the first of those adventures which the hachures have met with: adventures which have greatly injured their original beauty. The worst of these adventures was the cutting and joining to fit into newer and more convenient sheet lines. At this time ideas on the best size of map were altering. As we get across country faster and farther, so the inconvenience of changing maps leads to larger sheets, however tiresome they may be to fold. It may be added that the detail plate suffered almost as much, in this cutting and patching of unequally worn copper plates, as did the hachure plate. The necessity of redrawing for the new edition is largely due to this fact.

We come now to the days, just before the War, of the Killarney experiment, and of the new French 1/50,000 which caused such comment and had so great an influence. Alas! those too comfortable and easy days soon passed. The newer French style is pleasant but has need to economize away half the printings of its pre-war forerunner. The Killarney style stood self-condemned in the light of post-war retrenchment. But there are still some of us who shared in

those experiments, and who determined one day to return to the charge. Enter then the "Popular Edition." We have it now complete, and a very good clear map it is. The six or seven printings (the exact number depending on the "water" plates) give a clear sharp result. Hill features come naturally and clearly to the educated eye from the 50-foot contours in all but flattish country. This edition has, to my thinking, two great defects however. No contours explain minor features, small accidents of the ground, as do hachures, and they had gone, some thought for ever. Again, the violent red of the first-class road, calling the eye back whenever it strays to hill or stream, is as unfortunate as it is unnecessary. Here a word of apology is due. Cartography is an art. It touches questions of taste. As we know, we must not wrangle on such matters, but this afternoon it is my privilege to talk for a moment, and I can only give expression to my own views.

We must notice in passing the excellence of some of the 1-inch tourist maps produced in these early post-war years. A beautiful map of the Isle of Wight is a good example.

Next let us turn to the "Popular" as it appears for Scotland. It would be wrong and unfair to come to the new lettering of the "Relief" edition by any other path, for this is a study in evolution, and the impetus of Sir Charles Close's day—a second golden age for the Survey—is not yet spent. In England the detail plates of the Popular were transferred from the old engraving. Naturally the writing and symbols were not suitable for colour work. We were all aware of that fact, and in 1919 we began at Sir Charles Close's order to elaborate a style of writing proper to a hand-drawn map.

The "Perth Sample" will live long in Survey thought and history. Bold and neat compared with the transferred work the writing so evolved proved a great advance. The Popular of Scotland, with a countryside made for contouring (our first contoured map was of Schiehallion in Perthshire and was made in 1778), is a most excellent map. If only the red of the roads had been used with more discretion it would be hard to beat.

Then we come to the modern English revival of lettering, and, as good fortune would have it, we had the services of Captain Withycombe and of Mr. Ellis Martin. The style of the new detail plate was born. We do not all approve of every letter. No revival but carries us just too far in our enthusiasm. The alphabets are, anyhow, a great improvement, the writing is just sufficiently varied to escape flatness, and the new lower case sloping Roman (who had heard of such a thing a few years back?) is particularly good and particularly original. Accompanying these alterations on the black plate there was to have been a highly ornamental margin, but when it was tried it proved altogether overpowering. Clarity and a helpful presentation of our still beautiful country must take first place. Too heavy a marginal decoration distracts the eye and overshadows even so fine a feature as Dartmoor.

You will remember that the copper plates from which the last edition was taken were originally prepared for the third edition. Not only had subsequent revisions been made upon them but changes in cartographic thought had meant further alteration and the cutting and joining had led, here and there, to singularly unfortunate results. It was decided to recompile from the 6-inch. The Popular of Scotland had been drawn on "blues" (at 2 inches to the mile)

of the old copper engraved work. The new edition is taken directly from the 6-inch.

A recompilation means a complete break with the old copper material and offers opportunity for any other changes which experience suggests. The most important of these changes is the choice of a new projection. Practically all the maps of England had been hitherto on the Cassini projection. So far as the cartography of a relatively small area goes the Cassini gives the required accuracy. Its main fault is that it introduces rapidly increasing errors in the northing and thereby distorts angles. The distortion is not, of course, sensible on paper, but it is very sensible in direct comparison with nature. Suppose, for example, that a theodolite is set up over one of the old triangulation stations, and that the old bearings to other stations are reobserved and compared with those deduced from the coordinates. A substantial discrepancy will be found. In other words the projection, although quite suitable cartographically, introduces sensible angular distortion, and complicates the work of the surveyor in repairing or in adding to the national triangulation. It need not be assumed that this observer must necessarily be a soldier. The same inconvenience will be found by a mining engineer, or by one who may be surveying the site for some scheme of water conservancy and power. It is for this simple and practical reason that the orthomorphic type of projection is employed so generally by the civilized world in national mapping, and as the occasion provides the opportunity for following the same path we have naturally adopted it. The Transverse Mercator which we now use is in reality the orthomorphic form of the Cassini because it achieves angular accuracy by introducing into the easting an error similar to that already existing in the northing.

The central meridian of this new projection is 2° west of Greenwich, and from this meridian we can extend to cover Great Britain without substantial error. In order to do this the more efficiently we have chosen two lines which are parallel to the central meridian and lie at 200,000 yards on either side. Along these lines the cartography will be correct at the scale of the map. In the band enclosed between these two lines, and therefore including the central meridian, the presentation will be slightly smaller in scale than that actually assumed, but the change is so slight that distances remain sensibly correct on paper. Outside the two parallel lines presentation becomes progressively somewhat enlarged. Even however at the extreme limits of East Anglia the errors thus introduced do not exceed one part in two thousand.

Somewhere upon this central meridian we must then choose a point as the datum for our coordinate calculation. The datum point so chosen is the intersection of 2° west with 49° north. The surveyor is not of course hampered by changes of sign. The man in the street would obviously prefer numbers to run consecutively throughout the whole area. For that purpose to each computed coordinate is added 1,000,000 yards east and 1,000,000 yards north. This arbitrary number has been chosen purely for computing convenience and displaces the origin of numbers to a point well out in the Atlantic southwest of Great Britain. Where this point actually lies is a matter of no importance whatever. The result is that the coordinates of the projection run consecutively with the same sign northwards and eastwards.

I must now refer again to the past. On 17 March 1924, at an afternoon

meeting of the Society, a discussion was held on the question of grids. The discussion was so organized that the respective views of the man in the street, the Director-General of the Ordnance Survey, and the Officer in Charge of Geographical Army matters, were expressed and summed up in the discussion. To that interesting discussion I need add but little to-day, except on the convenience of the grid system of reference. A few words are necessary because it has been stated that the old 2-inch squares of previous editions did in reality serve all national purposes, and should not lightly be abandoned. The great point is that they have not served national purposes. It is probably felt by every cartographer who has had the opportunity to produce an extended series that he has reached finality in the matter of his sheet lines. After considerable experience in peace and war I find myself able to affirm quite definitely that finality in sheet-lines is never reached. Even with that clear and excellent Popular Edition as it now exists we have found it necessary to provide numerous tourist or special sheets for the convenience of this or that locality which has fallen awkwardly upon the normal series. The squares on these sheets are not of the same letter and number as those corresponding on the regular series. Moreover, 1-inch, $\frac{1}{2}$-inch, and $\frac{1}{4}$-inch references have no connection with each other or even with neighbouring sheets of the same scale.

Supposing that we look a little farther back, and supposing that the place-names of England had been indexed with great care upon the small-sheet series of Great Britain, that index would have become automatically out of date at the introduction of the larger sheets, or else a really practical convenience to the public would have been put off in order to save re-indexing. Such indexes as that I have quoted are bound to multiply in the future. For national efficiency those questions which rest upon population and communications must more and more become a matter for scientific analysis and reasoned organization. Just as the soldier found it necessary to index his country so that there should be no question of difficulty or error in referring briefly to any desired spot, so must the same problem arise in any intensive use of country. The corollary is that a system of reference must rest upon the measurement of the country as a whole and not upon the contemporary arrangements of sheets, an arrangement which is bound to be more or less ephemeral.

Exactly how the man in the street will apply the coordinates of our national survey it is difficult to foresee. The soldier has evolved his own technique, but his wants are not those of the civil population, whilst he is perhaps more hampered by the necessity of brevity, and yet less hampered by size of area. The civilian may want a reference throughout Great Britain. For the temporary purposes of a soldier references might be confined, shall we say, to Wessex or to East Anglia.

We shall presently come to a national technique in this matter. In the meanwhile the coordinate numbers are given clearly upon all the scales on to which the lines of the new grid have been put. These lines are of course parallel to the central meridian or to the perpendicular to that central meridian through the point of origin (2° west, 49° south). They are shown on the map merely as a convenience. Coordinates could of course be measured from the margins of the map without any grid lines across its interior surface. That would imply however long scales and considerable chance of error due to

distortion of the paper. For convenience, then, the surface of the map is broken up into small figures by these parallel lines, but it is to be noted that there is no actual necessity for these lines to form squares. For certain purposes, for example, it might be much more important to gauge distances east and west than north and south, and in such a case the lines shown on the surface of the map might be closer together in the east and west direction than in the north and south. It is however convenient and pleasant to the eye to maintain equal distances so that the coordinate lines do in practice form squares. The size of these squares is only important inasmuch as they should be neither too large for convenient sub-division nor so small as to interfere with map reading by reason of the number of added lines. On the new 1-inch scale lines are 5000 yards apart. On the ½-inch they are 10,000, and on the ¼-inch as soon as the new projection is adopted in that connection the lines will also be on 10,000 yards. These matters have actually been adopted in conformity with the opinions expressed at the meeting to which I have already referred in March 1924.

The use of the word "grid" is perhaps somewhat unfortunate. Nowadays it has an electrical significance. In its geographical signification it should be regarded as something which is independent of any scale, and which will allow us to refer with accuracy and despatch to any given point in such a manner that the rest of the world will be able not only to identify that point, but to find it on any map at any scale produced by the national survey. I might add that we are already compiling on this grid a gazetteer of all the place-names which fall upon the 1-inch together with their coordinates. In using that gazetteer with other scale maps it need not be assumed that every name will be found upon them. The ¼-inch, for example, must omit a very large number of names upon the 1-inch. But the actual site, if not the name, will be identifiable without trouble.

In considering the new 1-inch we have now finished the discussion of the detail plate with its margins and its reference system. The important question of the relief still remains. Hachures are valuable in detail, untrustworthy in relative emphasis, apt to carve out rather than to round off; and our English hills are mostly rounded off. Layers are a conventional sign rather than a natural presentation. Hill shading is apt to confuse minor features, is often used in violent emphasis and unpleasant colour, but can be useful and is natural to the landscape. Finally, contours and spot-heights are the only reliable measure of altitude. Can they all be married off? I think they can and that the new 1-inch is proof. But if so, layers, hachures, and shadows must be regarded as mere aids to the general effect. The layer convention is really destroyed by the added colour of the hachures. The relative emphasis of the hachures is lost in the layer. Neither are referred to at all in the margin therefore. They have no individual significance on this map. They are parts of a whole. The general scheme is directly inspired by the Killarney sheet, but with the modifications imposed by the two considerations regarded as axiomatic. The map must not cost more than the popular, and must not take longer to prepare. We have therefore used existing material, have avoided the crayon shading of the Killarney, and have combined printings so as to keep within the number of the popular.

Mr. Hinks in a very kindly article has dealt with the projection, and indeed the whole map, and it is on view here and now. I need, then, say no more until I have to answer criticism, except on the one question of roads. An important committee asked some years ago for the vivid red. True, but committees of laymen should apportion urgency, and leave the choice of appropriate line, symbol, writing, and colour to the map-maker. That is what we are paid for. It should also be remembered that modern roads have improved as much as modern cars, and that any motor vehicle can use any second-class road.

If the 1-inch is but a modified Killarney, the new ½-inch is also inspired by the experiments of the past. Our ½-inch was in answer to a call from the War Office in the days when war maps were not printed in the field, and when one single scale was deemed sufficient for general and private, motor car and Shanks's mare. Names on this map were typed and not written, and are, to the modern eye, cramped and inferior. We cannot afford to redraw however. It was produced with a hill-shading, or with layers, and, for a few brief years, with both. The combined edition had the germs of success, but it defeated itself by a too pretentious layer system (no less than seventeen on the Alnwick sheet), by a vile bottom green, and an equally dreadful bluey top layer. In fact, the colour might have been laid on with a trowel. The hill shading was a brush drawing, photographed through a screen, photo-etched upon copper, worked on and improved in that stage, and finally transferred to stone. The stones have been cleaned off, but pulls from the copper plates exist. It is these we have used, and just as the 1-inch shadow is obtained by erasing the "sunny" side from a duplicate hachure plate, so in the ½-inch have we used a doctored plate of the hill shading.

A word on this question of the supposed direction of light. A map is normally held or laid before one with the north edge farthest away. The map-user, then, keeps "south light" from the map which is lit from opposite (or "north") (or, on the office table, most commonly from the north-west). This is the only but quite convincing reason for a convention which is continually being called in question by the ultra-logical.

The new ½-inch is not the equal of the new 1-inch. We may do better yet, and in this connection I should like to refer to a most useful and instructive correspondence with Mr. Hinks. We shall certainly alter the margins and we may modify the colouring, but, on the whole, we are content to think that this new ½-inch is a great advance on its predecessors. I shall leave you to judge.

Now that we have discussed the new 1-inch and ½-inch maps I should like to refer to some other maps. If any one prefers a plain uncoloured 1-inch map let them try the outline editions. They are excellent and clear maps for those who really can visualize country from contours. If any one desires to study physical features without the possibly disturbing effect of the detail and road plates let him try the physical edition.

Colonel Johnston referred to the ¼-inch. He spoke of the first edition. It was one based upon Mudge's maps and singularly inaccurate according to our standards. The new post-war ¼-inch is a clear and excellent map. As it first appeared however the sheet-lines were not always happily chosen. These have been revised, and although it is impossible to please everybody, a general liking for the new arrangement is reflected by the sales.

There is a sheet of the civil aeronautical edition in which railways, water, and woods are given the prominence which the pilot demands. To emphasize railways and water is easy, but as the bottom layer of the normal edition of the ¼-inch is green it was impossible to show woods clearly without removing that layer.

Now I pass to the 10-mile map which is all too little known. It is most useful for any one who covers the face of this country in visit or inspection. The best of maps on which to plan a journey or to frame a country wide administration, it deserves far more notice than it gets. It is on this scale that we are preparing a new map for the Ministry of Transport in order to give a clear general guide to the scheme and to the road numbers. This road map will, presently, be on sale and will be so designed as to include on one sheet, mounted on both sides, the whole of Great Britain. This type of mounting has the appeal of ingenuity and is as handy to examine as a whole as it is to use section by section, in a car.

The Ministry of Transport map introduces, fitly enough, the question of the road directions in the margins of our small-scale maps. In the "hunting map" times before even the bicycle had appeared it had been the custom to describe a road as coming from, or going to, the next village. To-day all the main roads have definite names or at any rate definite final objectives. There may still be many who want to know about that neighbouring village; there are just as many whose next stop may be 100 miles away.

We are trying, then, to think in a wider sense and to help the motorist to see his way clear with the minimum of trouble. We have an overlap now on our 1-inch sheets. An overlap is little use in a car however. The bother of passing from one map to another is not thereby avoided. It helps more to have a label on the end of each road, so as to key one to the other, and to ensure that it *is* the London, or the Portsmouth, or the Edinburgh road one is following. On the new ½-inch Cotswold map we have tried perhaps to be too clever. We are sure that the scheme can be bettered, and if any of you know of a "better 'ole" we will gladly go to it. Still on the question of traffic direction we have begun to bind in with the ¼-inch traffic diagrams of the more difficult towns and villages. These diagrams, conventional and not to scale, are easy to make, for our boys under instruction draw them, and they will be useful to the motoring public. No doubt we all remember the times when the partner of our travels has remarked, "But, my dear, the map shows clearly that the second turning was the right one!" The ¼-inch itself cannot, and does not pretend to show every turning.

When we come down so far in scale as the 1/Million I think the audience may cease to be wholly interested. It is the scale of the historian and of the internationalist. Yet presently it will assume an importance as yet undreamt of except perhaps by Sir Charles Close on that afternoon cruise when the international 1/M was born. Historians, scientists, geographers, and politicians (I feel that I should have given these in alphabetical order) are gathering information at a rate and in a volume which are too much for atlas scales. We shall see an increasing use of these 1/M maps as illustrations both of the past and of the hopes for the future. This Society took a worthy part in the preparation of 1/M maps in the War. Since then the Ordnance Survey has indulged now and again in a busman's holiday. We have our Physical, our Roman

Britain, and our Seventeenth Century England editions. We shall soon have, I hope, our Saxon edition. We should have our population edition, and it should be one of hundreds of similar sheets to cover the civilized world. Where is the map of the Ancient Cradles of Civilization, where can we study the wonderful travels of Herodotus and Alexander the Great? These maps will come, but all we can do now is to show such editions as we have got.

DISCUSSION

Before the paper the PRESIDENT (Admiral Sir WILLIAM GOODENOUGH) said: There is no part of the work which we do in this Society which is more interesting, more useful, and, indeed, more fascinating than that of the actual making of maps; and everybody knows that the making of maps comes largely under the Ordnance Survey. We have with us this afternoon Brigadier Winterbotham, the Director-General of the Ordnance Survey, who will tell us of the small-scale maps of the Ordnance Survey in a lecture which I now ask him to begin.

Brigadier Winterbotham then delivered the lecture printed above, and a discussion followed.

Colonel Sir CHARLES CLOSE, *who was unable to be present throughout the meeting, left the following notes which were then read by Mr. Sclater:*

I much regret that I am prevented from having the pleasure of listening to Brigadier Winterbotham's paper on "The Small-Scale Maps of the Ordnance Survey"; but he has kindly sent me a copy of his paper, and I write these few remarks after a study of the paper and of the specimen 1-inch and ½-inch sheets which he also kindly sent me.

As a former Director-General it is a great pleasure to me to see my old Department steadily progressing, particularly because, as we all know, after the War a very necessary period of intensive economy set in, and a good many pet schemes had to be dropped at the time, and amongst these we had to abandon the proposed new type of 1-inch map. The type of map will be found, as I have said in a letter to the *Geographical Journal*, in an illustration in the 'Text Book of Topographical Surveying,' second edition. I may say, in parenthesis, that the Ordnance Survey was almost the only public department which did genuinely economize; it is a great pity that all public departments did not follow suit, and some of our present financial troubles are due to their failure to do so. Well, the present Director-General has found the means of producing approximately the same type of map with fewer printings, thus paying due heed to the imperative need for economy.

I think that the result is very successful, and I congratulate the Ordnance Survey on the production of an admirable map. I personally like almost all the new features of the map; the use of the combined effect of contours, hachures, and layers, in much the same way, in fact, as had been intended eighteen years ago. I like the new lettering, and think that the adoption of the Transverse Mercator as a projection is a very desirable improvement—by the way, I hope that it will not be called the Gauss Conformal: "conformal" is rather an ugly and somewhat meaningless word, and Gauss did not invent the projection. With regard to the use of coordinates, it must be confessed that, though these are more exact and scientific, they are not as convenient for ordinary purposes as the old marginal numbers and letters. This small change has the disadvantage that it rather upsets the system of the English Place-Name Society, which is doing such excellent national work. Up to now, all the place-names have been referred to

the marginal letters and numbers of the now obsolescent 1-inch map, Popular Edition. But I don't see what can be done in the matter.

Technically there is one point to which no doubt due attention has been given, but which may perhaps be mentioned here. The use, in order to save the preparation of new plates—a most laudable reason—of the south and east portions of the old hachure plates, printed in mauve, will obviously require great care. In the lighter portions it seems successful; in some of the heavier it tends to smudge. A specially drawn shade would, without doubt, have a cleaner result. When this country comes on the gold standard again, perhaps the extra cost of the preparation of special shade plates could be afforded. But the matter is not of first-class importance. However, these are small matters. I look upon the new map as very successful, and congratulate Brigadier Winterbotham and his Department on its production.

As to the new ½-inch, it seems to me to be a decided improvement on its predecessors. The old ½-inch never was a very happy map; the mistake was made, more than twenty years ago, of typing the names; perhaps, one of these days, it may be possible to draw the names in the excellent new alphabets. Otherwise the new ½-inch is to be welcomed; it has many merits and should be most useful to motorists. I will end these remarks with a note about the ¼-inch. This map was finished ten years ago, so far as England and Wales are concerned. I shall be interested to learn the new arrangement of the sheet-lines. I gather that the map itself has undergone no change.

Colonel M. N. MacLeod (Geographical Section, General Staff): The introduction of the completely new series of 1-inch maps by the Ordnance Survey is a cartographic event which I think very few are privileged to witness, a thing that happens barely once in a lifetime; and it has been a great privilege to us to hear direct from the Director-General himself the plans which he has made to take advantage of this unique opportunity. Personally I feel lost in admiration at the extraordinary ingenuity and thought that has been put into this production: the way in which the Director-General has made use of existing material, adapted it, and, so to speak, modernized it, is I think quite remarkable. Though it would be effrontery on my part to offer him praise, I hope he will allow me to congratulate him on what he has done and on the effect that has been produced.

The map is a departure from orthodoxy in a number of ways, and in criticizing it one has to try, if possible, to adopt different points of view. One may criticize it from the point of view of the public, or from the point of view of the soldier, or that of the financier—the man who has to pay for it—or from that of the artist, and it is not always possible to reconcile all those points of view. At the same time, I think the new map is a very excellent compromise between them, and if we compare it with the old map that Brigadier Winterbotham showed—which was a very good map in its day—there is no doubt that the new map is a vast improvement in clearness and legibility.

I would like first to say a word or two about the grid system, because that is one of the biggest departures from current practice. The grid system is an adaptation of the requirements of the soldier to the requirements of the civilian. It is another example of "turning swords into ploughshares." Looking at the map from the military point of view the soldier has to consider the use which has to be made of it. He naturally uses the Ordnance Survey Map for training, but it is also necessary that he should look a little farther and envisage the possibility, though I hope it will not occur in our lifetime, of the nation having to be mobilized and the civilian once more turned into a soldier. It will naturally be the greatest advantage to the military authorities if the recruit, when he first dons his uniform, is already familiar with the grid system. Brigadier Winterbotham has pointed

out that on the ½-inch map a 10,000-yard square is used, and on the 1-inch map a 5000-yard square is used. The soldier uses his coordinate system in two ways: he has what he calls a "map reference" system, the object of which is solely to indicate position, and he uses the coordinate system proper for such things as the calculation of ranges for artillery. The system is such that the "map reference" is an abbreviated coordinate. But the map reference is based on a decimal subdivision of the square, and you will find that if your square is not in multiples of tens of units, the map reference, based on the decimal division of the square, will not be an abbreviated coordinate. That of course can be got over by certain devices, but those devices are all, in a sense, the abandonment of the decimal system of division of the square. Now I suggest that there may not be any necessity to make the square on the 1-inch map 5000 yards. Is there any reason why it should not be 10,000 yards? The old system consisting of a, b, c, d, etc., down one margin, and 1, 2, 3, 4, etc., along the top only enabled one to define a point to something like a mile. Now the tenth of a 10,000-yard square is a good deal more precise than that, and if we want a still closer definition it is easy to get a measuring scale and so arrive at the correct figures. Is there any particular merit about the square of 2-inch size? The smaller the square the more it obscures the map; I suggest to the Director-General that he might consider putting 10,000-yard squares on the 1-inch as well as on the ½-inch map.

One other point before leaving the grid system. The Ordnance Survey has adopted the yard as the unit for its grid. Brigadier Winterbotham did not tell us the reasons for taking that as the unit, but it is a fact that the surveyor's units have hitherto been the foot or the metre. Perhaps Brigadier Winterbotham would tell us why he has abandoned those two units and adopted the yard instead.

Next I would like to offer a few remarks on the relief. Here I propose to criticize not so much from the point of view of the artist as from the point of view of the soldier. The soldier specifies certain conditions under which the map must be used. Until recently those conditions were usually a dug-out in which the map had to be read by the light of a single candle. If the map could not be read under those conditions some people said it was no good. Recently that specification has been considerably stiffened and the condition we are asked to legislate for is the interior of a tank in which apparently the only light falling on the map is lubricating oil! The soldier requires contours to give him numerical information. He has, for example, to determine the height of his gun and the height of its target in order to work the "angle of sight" (the angle of elevation). When he has to do that under the rather stringent conditions that I have specified it is a great help to him if some of the contour lines are drawn thicker so that he can count easily from the nearest thick line, or nearest spot-height, and get the value of the particular height he desires.

Another point I should like to mention is the question of shading. Great ingenuity has been shown in the way those existing hachure plates have been used, and I thought that the Physical Edition of the 1-inch was extraordinarily good. It showed up the shape of the ground very well. But some of that clearness is lost when all the names and all the writing are superposed on it; it seemed to me that just as in those other respects where Brigadier Winterbotham told us it had to be done, the relief also might have been accentuated still more, even exaggerated a little, so that when the roads, writing, etc., were printed on top it would show up through them. I suggest that that might be done by introducing a "half-tone" somewhere in the scheme. By the present arrangement not only that part of the hill which faces the light is left white, but also all parts which are level as well. I believe that, originally, hill-shading was only put on to the "shaded" side of the hill in order to leave as much white paper showing as

possible. That idea has now definitely been abandoned. As you have seen, the whole map is covered with tints. I suggest it might be possible to bring out the relief still more by only picking out white the parts of the hill which directly face the light, leaving the flat summits and valleys in half-tone and the actual shadows in still darker tone.

Now a word about the ¼-inch and 1/M. These two maps are coming more and more into use for flying. They are typically the airman's maps. The Air Ministry have initiated and are asking the Ordnance Survey to produce a special airman's ¼-inch. Perhaps Brigadier Winterbotham would say a few words about that, because that is a use for a map which, it seems to me, will come more and more into prominence as time goes on. The requirements of the airman differ in certain respects from the requirements of the man on foot. There is no consensus of opinion yet among airmen as to what is the best style of map, but it is interesting to see, I think, the trends in that direction.

Then a word or two about the lettering. I must say I think the lettering on the new map is very beautiful indeed. I admire it very much. At first I had an idea that it would be an improvement if more use was made of the upright type. I believe it is no accident that a book is printed in upright rather than sloping lettering; when you have to show a lot of names, words, and letters in a small compass they are clearer if printed upright rather than in italics. But if you compare the 1/M International Sheets in which nearly all the lettering is upright, I think you will agree that the effect is monotonous in comparison with these new maps. Brigadier Winterbotham and Sir Charles Close have rather condemned the use of type, but I cannot help feeling that their objections might be overcome by the choice of suitable founts. Typing is decidedly cheaper than writing; it costs half as much, and I personally do not dislike a typed map provided the type is properly selected. I believe founts could be made to match the new style which has been introduced by the Ordnance Survey and could be employed not perhaps with advantage but certainly with economy.

Last of all, a word or two on the question of margins. I must confess that in this matter I think Brigadier Winterbotham's margin is an improvement. I was not very greatly taken with the highly elaborate margin which was once suggested by Brigadier Jack which seemed to me, on a proof copy of the sheet which I saw, to overshadow the sheet very much indeed. After all, every map is a convention, and if you depart too much from a convention in search of decoration it seems there is no limit to what may happen. We might find ourselves reverting to maps like the old ones of the past in which mermaids and sea-serpents disported themselves in the sea.

Mr. H. E. DALE (Ministry of Agriculture): I am very glad to say a few words, not to criticize Brigadier Winterbotham's paper, but merely to assure you that the Ministry of Agriculture is very sensible of the importance of the work of the Ordnance Survey and will do its utmost to ensure, even in these hard times, that it does not suffer any diminution or injury which can be avoided.

It may seem an odd arrangement that in a highly industrialized country such as ours the Ordnance Survey should be under the Ministry of Agriculture, but I trust it is an arrangement which Brigadier Winterbotham will not wish to alter, and it certainly is not an arrangement which we want to change. We are proud of our association with the Ordnance Survey, and (through it) with such men as Sir Charles Close. And it is not merely a matter of pride: we have a very lively sense of past favours which the Ordnance Survey has conferred on agriculture, and we have a lively hope of favours to come. Every one knows, of course, that the buying and selling of land—an occupation which still goes on even under the somewhat depressed circumstances of the moment—depends very largely on the

work of the Ordnance Survey for its accuracy and for its legal value. There is the work which the Ordnance Survey does for the Geological Survey; this again is of the greatest interest to agriculture, for geology is one of the sciences on which agriculture is based. Finally, there is one particular matter which I should like to commend to the attention of every one interested in agriculture, and that is the agricultural map of England and Wales which the Ordnance Survey produced some years ago and which is now coming out in a new edition. Any one who takes the least interest in agriculture will find that map not only agriculturally valuable but also historically and socially useful.

I am scarcely competent to speak on the paper in detail, and I must leave that to the experts present: I need only conclude by thanking Brigadier Winterbotham for his paper, and the Society for the opportunity of saying these few words.

Mr. HINKS: I confess that when we were promised an ornamental border by Brigadier Jack I looked forward to it with great pleasure because I have always felt that we have gone too far in making our maps severe and unadorned. At the same time, I quite appreciate Brigadier Winterbotham's horror at the danger of having angels and cupids in the personnel of the Ordnance Survey.

In the course of the last fortnight I have had a remarkably interesting correspondence with him upon the details of the new ½-inch maps, on which he did me the honour to ask my opinion, and I am flattered to find that two or three of the suggestions I made for the border have gone so far as to be included in the specimen shown on the screen this afternoon. To my mind you can get all, or nearly all, the decoration you need by making the necessary division of those borders into a sort of elongated chequer pattern such as we use in the page-blocks of the *Geographical Journal*, and such as might, I think, be used upon the borders of the Ordnance Survey sheet. Brigadier Winterbotham has tried the idea of separating the two borders, and I would ask him whether he does not think they have been made, in the Ordnance Survey specimen, a little too narrow. If those divisions were made rather broader I feel that they would add a definite decorative effect.

There are a number of points upon which Brigadier Winterbotham and I have had a great deal of discussion, and on which the last word has not been said, such as the method of numbering the grid, references in the margin to the destination of roads, and so on; but I ought not to speak further about them now. I would only express my thanks to Brigadier Winterbotham not only for having appreciated what was written about the 1-inch map in the October *Journal*, but also for his kindly reference to his correspondence with me about the ½-inch map.

Major E. M. BULL (Ministry of Transport): I have listened with very great pleasure to Brigadier Winterbotham's lecture. We use the Ordnance Survey maps to a very large extent, and it is particularly gratifying to know that we are to have a grid system of map reference by which any two individuals can be perfectly certain that they are dealing with precisely the same place in the countryside. In France that was most essential, and I remember how useful the system of map reference was on the 1/20,000 and 1/40,000 scale sheets. The new borders on the ½-inch map will be most useful, and the numbers of roads being given it will now be easier to identify the course of a road from one sheet to another. I know I am expressing the Chief Engineer's wishes when I say we thank Brigadier-General Winterbotham for his hearty cooperation with the Ministry of Transport in all matters in which the two Departments are interested.

Mr. REEVES: The layer system, notwithstanding all that can be said in its favour, certainly has its disadvantages and limitations, and I have long felt that for exhibiting the general topographical features and relief on a map of this kind there is no better method than that of a combination of contours and shading

much on the lines of that now adopted. If carefully carried out the land forms and true heights are given by the contours, while the shading gives a graphic effect to the relief.

As regards the relief on this sheet it appears to me that there is room for some further improvement, and, although perhaps better in colour, I do not think it comes up to the excellent Killarney sheet which has been referred to. In places the hills and valleys do not stand out quite as they might, and there is, in parts, a lack of definiteness about them that might be obviated by a little more oblique illumination. When there is a sufficient number of accurate contours, as in this case, there is no chance of any one being misled by supposing the light to fall on one side of the hills more than the other, and the graphic effect of relief is frequently greatly enhanced.

The rivers and lakes are very properly shown in blue, but why not have the names of them in blue as well? This is a great help when looking for a place, especially on a small-scale map full of names, for one knows at once that if a name is in blue it refers to water of some kind. This is now being done on several Government surveys. To transfer all the water names from the black plates to the blue plates would doubtless be a serious undertaking, and it is perhaps too late now to make the alteration.

On the subject of the lettering I am on dangerous ground. Well, my opinion is that Captain Withycombe has developed a style that has many points in its favour. Still, I do not think it is as suitable as the best lettering already on Ordnance Survey maps. Brigadier Winterbotham has shown on the screen specimens of lettering amongst which is that of the 1-inch Scotland. On this the fine hair lines have been thickened and made clearer, and generally speaking it is in my opinion excellent, leaving little to be desired. On the new 1-inch sheet we are considering I am pleased to see that no attempt has been made to keep rigidly to one style of lettering, for I notice that at least three styles have been used. Another good feature is that it has a restrained and simple border.

I quite agree with what Brigadier Winterbotham said about the figures. There is frequently little space on maps to write the figures for spot heights and contour numbers, and the simpler and more compact they are the better. The figures ordinarily used are perfectly clear if they are properly written. I feel it would be a great mistake to try to adopt the new figures, at any rate on small-scale maps crowded with detail.

Professor C. B. FAWCETT: As one of those whose business lies not in making maps but in using them, I have been very glad to have the privilege of listening to Brigadier Winterbotham's paper. I feel I am expressing the opinion of my colleagues when I say it is, for us at any rate, a very great advantage to be able to get a map in separate sections: the relief and the outline editions and possibly also, we hope, the water alone. Also from the point of view of the geographer I should like to welcome the new grid system. The old reference by letters and figures was fairly adequate for use with a particular sheet of a particular map; but the limitation to one sheet made it of very little use for any one who needed to refer to maps on different scales. It also made the reference more cumbersome.

Some work will be involved in the transposition of recorded references to the new system. But I think the difficulty of transfer is very much counterbalanced by the great advantage of the new system which, it seems, depends largely on the new projection which is being used. On all those points I feel I have nothing but congratulation to offer. But there is one point I should like to raise. I have been looking at some of the names that are printed on the new edition of the 1/M map. I do not know on what system the selection and placing of the names has been decided, or who decides it; but on one of the maps shown outside there

are names which are not correctly placed. Also our old friend the "Lincoln Gap" has been rechristened the "Witham Gap." I do not know the source of this new name, but the older name is the one in general use, and, I think, the more satisfactory. Not by any means all these names of physical features and of districts are agreed upon; and to find the general usage may in some cases be difficult. The Ordnance Survey has a very great influence in establishing local names of this type, and in giving them wide currency. Hence the Survey has a special responsibility in the matter.

Brigadier H. S. L. WINTERBOTHAM: Several questions have been asked, and I do not think I can answer them all now. Sir Charles Close spoke of the name "Gauss Conformal." I used to know the projection in question by that name, but agree that, for various reasons, the expression "Transverse Mercator" is better and more descriptive. Sir Charles Close prefers the old square to the new grid. As the years go by thought inevitably progresses and brings about changes. I do not agree that the square referring always to a particular sheet (which may be out of print) can be considered the equal of a national and lasting grid, and it is about the only thing I do not agree with Sir Charles Close about. I am sure the grid is better.

Colonel MacLeod has raised a number of questions, some of which I will not answer now. The size of the square, we may say, is dictated by finding the balance between what is theoretically desirable, what is pleasing cartographically, and what the public is accustomed to. Colonel MacLeod talks also about the unit of length, and suggests a 10,000-foot side for the square. In referencing the unit is not very important. One may have a yard here, a metre elsewhere, and a foot somewhere else. The ultimate division is a measure by eye and depends upon the length on paper. It is however preferable to adopt a unit which is easy from the surveyor's point of view—coinciding with his unit of survey measurement—and at the same time is in customary national use. The yard, in England, is the best compromise. Any sane man can pass from yards to feet if he desires.

As regards the particular needs of this or that variety of up-to-date soldier I agree that it is very difficult to find an answer which may be considered generally suitable. There must however be one clear, detailed, and really useful map. Particular needs will have to be met in the future, as in the past, by special editions.

Colonel MacLeod talked about the Air Edition of the ½-inch. It is a pleasant map, but I have doubts as to its suitability as a scale. The map for use in the air varies with the amount of quickly recognizable detail and the visibility. Generally speaking, in clear weather, the man in the car requires a ¼ inch; the man in the air, travelling much faster, would, I think, prefer the 10-mile, if he can see far enough through our not very clear atmosphere.

Colonel MacLeod spoke of typing or stamping names, and asked why we are not using that method on the 1-inch. Typed names are used on many good maps, but they tend to make the map flat because of the necessary formality and sameness of letter and spacing. On a hand-written map names are fitted in with minor variations of size and spacing, proper to the occasion, and pleasant to the eye. If one takes up a hand-written map it will tend to show the little personal characteristics of the draughtsman, so that the expert may say, "Mr. Scotland did this." Fitting in names on so full a map as the 1-inch is not easy.

Then, as regards Mr. Hinks's remarks on the width of the marginal scales, I am sorry to say that I myself drew the models for these scales and laid down width of line and border. No two people of individuality can see entirely eye to eye, yet we are much in Mr. Hinks's debt, and his ideas, if not his exact dimensions, will be incorporated.

Mr. Reeves said that the Killarney sheet is better in its presentation of the relief. Admitted, yet the finger of God has as much to do with that fact as the hand of man. On the Plymouth sheet we have the infinite variety of the normal English countryside, on the Killarney bold mountain, wide plain, open water, and a clear-cut drainage. I could not in any way question the excellence of Sir Charles Close's topographical scheme, but I do maintain that he had an easier job.

Professor Fawcett has asked some questions about authority for place-names in the 1/M. I have taken the questions to heart and will reply in writing. I cannot give the answer here and now, because I do not know it.

The PRESIDENT: I wish I was not timekeeper as well as President, for there is much I should like to say. When I find myself among a body of experts, as I do this afternoon, I put myself in the position of one of the general public. I say to myself, "What do we demand of this great public body who make our maps?" We demand such a map as Brigadier Winterbotham and his predecessors have given us; a map which when we look at it shows us the natural features of the country, by which we can go from place to place with comparative ease and, so far as our upbringing goes, with no great previous knowledge of how to read a map. What we demand of the public is that they should be able to read a map, for it is a most extraordinary thing that people of all countries travel from place to place more and more, and more and more they display their entire ignorance of what a map really means and how properly to read it. I feel quite sure that Professor Fawcett and his colleagues whose business in life it is to teach geography in all its forms to the rising generation will teach them how to read a map. And I am glad to hear we are paying more attention to the air maps.

You have given us a most interesting afternoon, Brigadier Winterbotham, and we are very much obliged to you: not only a very interesting but also an entertaining afternoon. You have put problems before people which will give them much to think about; and we ask you to accept, on behalf of the audience and of the Society, our most sincere thanks.

THE PURCELL SOURCE OF THE KOOTENAY RIVER

J. MONROE THORINGTON AND EATON CROMWELL

THE portion of the Purcell Range in which the eastern drainage transfers from the Columbia to the Kootenay river is of interest to geographers, if for no other reason than the spectacle afforded by these two rivers flowing in opposite directions within the Rocky Mountain trench. The section containing the source of the Columbia has been described by the writers in a previous paper,* and in 1931 we were able to visit the region again and continue our investigation of the southern portion of the watershed.

Accompanied by the guide, Edward Feuz, Jr., we left Golden on June 23 and reached Radium Springs (Fairmont) that evening. Long ago the Indians came there, and the fame of the waters was known to Sir George Simpson in 1841 at the time of his overland voyage around the world. There are photographs dating from the eighties of bearded gentlemen, otherwise nude, lolling in the natural pools, with bottled beer at hand. Now it has been civilized with tiles and electric lights.

On the following morning we drove past Columbia lake, crossing Dutch creek just above its mouth, and followed the road above Canal Flats to Findlay creek. South of a purple promontory, opposite, the Kootenay river carries its flood from the Rockies and expands in meandering brooks and backwaters on the green marshes. The old canal built by Baillie-Grohman to divert the Kootenay water into the Columbia is still to be seen, with the partially filled-in lock close to the road at Canal Flats station.

Findlay creek, the most northern Purcell stream tributary to the Kootenay, is paralleled for a short distance by a branch railroad for logging, and a few miles up small tractors are busy hauling timber to the cars. There are stands of enormous white-pine and groves of tamarack, a metallic forest with trunks that glint with coppery tones in afternoon light. They have reached an advanced age and the lower wood is rotting, so that some would soon fall if they were not cut. We were told that single trees contain sometimes more than 2500 board feet. We met Conrad Kain with the horses in camp at Findlay bridge, where a road crosses to the south and a pass leads to Skookumchuck creek. The road on the north side continues over a higher plateau, where the valley broadens and makes visible the amphitheatre of wooded hills that still hide the watershed peaks in the west. The ground is parched and covered with coarse growth of sage, sedum, and vetch. Clouds of fine grey dust rise as the horses pass by.

At the end of the road a trail branches northward toward the gap leading over to Deer lake and Dutch creek. A lateral stream comes down through the old flumes of a gold claim. There are ruins of buildings for the miners; but the cabins long ago burned to the ground and weeds grow in the crumbling chimneys. The westward trail leads at first through open tamarack forest, with a few large firs and poplars. Then, during the next 10 miles, there are slopes of jackpine and many promontories to be rounded on stony slides. The

*Thorington and Cromwell, "The Purcell Source of the Columbia River," *G.J.*, vol. 77, no. 5, May 1931, p. 455.

path is bordered with wild roses, pink and white; larks and robins are singing, and woodpeckers tapping everywhere.

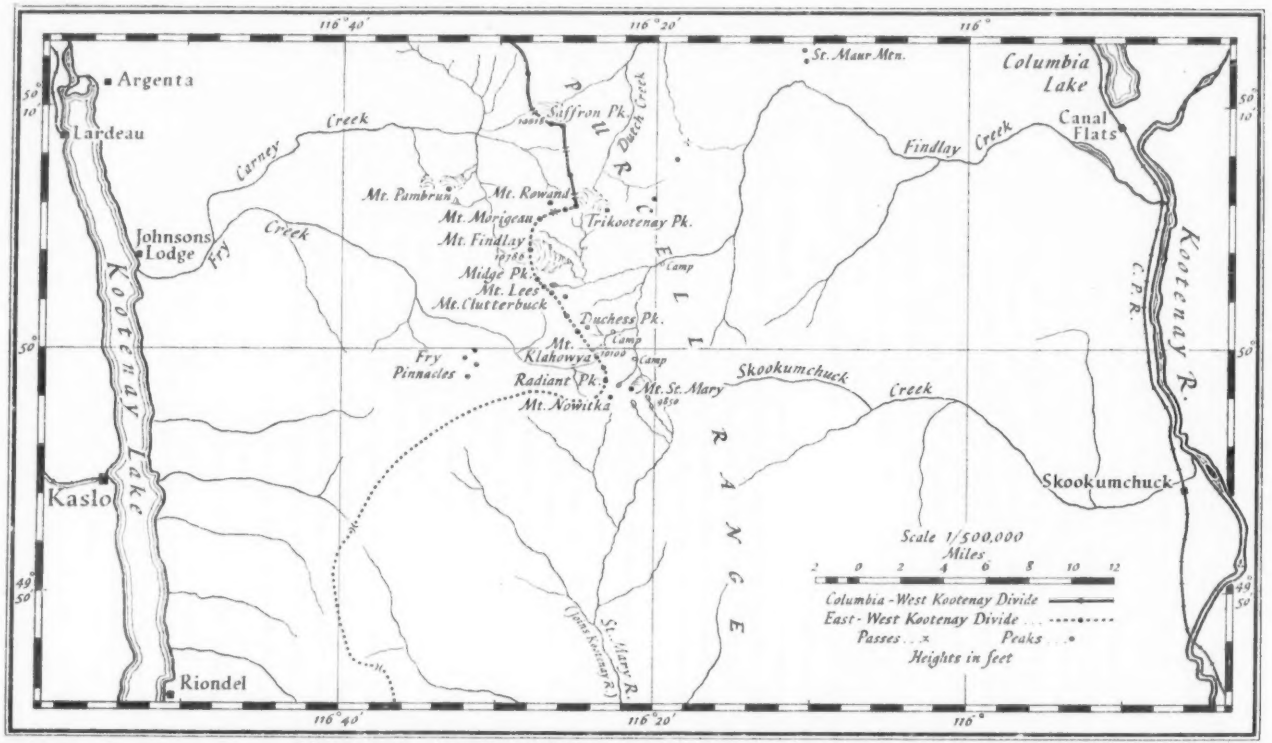
Rain and lost horses caused delay. We had passed the bend where the valley makes its first abrupt turn to the south, and had travelled along the overflowing stream, with horses frequently bogged down in mudholes. On June 27 we forded the main creek where there is an acute curve and a considerable tributary enters from the south beside some log-cabins in a clearing. On the fast water several ducks came down with a tumultuous honking and caused momentary confusion among the horses. Later on, when we camped, the clouds that all day had covered the mountain tops rolled slowly back. A snow-decked peak appeared through a narrow gorge to the west, recognizable as Mount Findlay, which we had ascended in the preceding summer. For the first time since starting we had a known landmark and could check our position. The mountain rose nearly 6000 feet above us, with the lower dark moraines almost the only visible rock, new snow mantling all the rest of the gleaming pinnacle that pierced the cloud layers. The main valley here makes a second and final right-angled bend to the south.

Next morning we found new snow far down on the hillsides and a rainbow clinging to the clearing mists. Half a mile uptrail we were opposite the entering stream from Findlay glacier, with Mounts Morigeau and Rowand towering across its basin. A little later we entered an area which was burned over during the summer of 1930. Roots and top-soil were charred to powder, leaving holes between the stones that were treacherous to the horses. For the most part however our progress was facilitated; alders and undergrowth were no longer a hindrance, and wind had not yet blown down the larger trees. But the sloughs were unchanged, and at one time we had three horses with morass to their shoulders; all the loads must be unpacked and the beasts dragged out bodily. Findlay creek was growing smaller and to the south seemed hemmed in by a broad snowfield that lifted a white curtain above the fire's desolation. We crossed the stream and entered a lateral valley coming from the west, rising rapidly to a green basin with cliffs and waterfalls at its head.

All our attempts to bring the horses quite to this cirque were in vain. Stone slides, some 3 miles in, extend from either side of the valley and end in swampy ground, with intervening timber and undergrowth so dense that progress became impossible. Packhorses disappeared almost completely in the tall ferns and bushes; this is a zone of rainfall, and foliage is nearly as luxuriant as in the Selkirks. We turned downstream and camped on a sandy bar beside the water, at a barometric elevation of 5670 feet.

On June 29 we reached the summit of a high snow peak, Mount Klahowya, on the south side of our lateral valley, in an ascent of less than five hours, its elevation proving to be 10,100 feet. Snow flurries unfortunately obscured much of the view, but we took bearings and discovered to our satisfaction that we were on the main Purcell watershed, with the basin of Fry river precipitously below us on the west.

On July 1 we re-entered the burned area on Findlay creek and continued southward. Not a wild creature was to be seen; no beast or bird. Only along the margins of the brooks were there vestiges of green. We became black as coal from rubbing against the trees; the packs were in the same condition, and



Sketch-map of the Purcell Range and sources of the Kootenay River

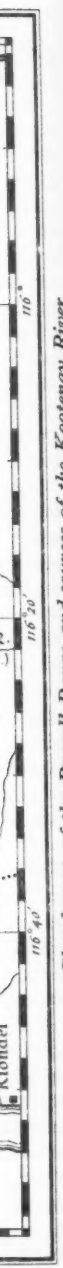
our two white horses became striped as zebras. At last we came to the margin of the old fire, where rain may have arrested it; where the trees were crisply brown with needles not yet fallen. At the edge of a brook this was over and we crossed into the brilliant complement of green foliage once more, as if in a step from autumn into spring. From our horses we saw the great snowfield in the south, larger as we approached and filling the head of the valley. We camped 3 miles below it, with rushing water close to the tents and a ridge crowned with larch behind, making a lacy silhouette against the sunlight.

The sky was crystal blue on the morning of July 2, with the snowfield and its tent-like peak hard and white. Three hours in the forest gave us less difficulty on foot than we had expected, for there were many game trails and even an old trap-line, now abandoned, above the fire zone. The stream forks acutely south-east and south-west, with a small central tributary falling from the snowfield. We crossed the south-eastern brook through a tangle of mossy logs and followed open glades below the snow.

South of Findlay creek, the important Purcell tributaries of the Kootenay river are Skookumchuck creek and St. Mary river, the latter joining the Kootenay valley at Fort Steele. One of the first things we noticed, as we climbed higher, was that the south-eastern terminal fork of Findlay creek begins in a blue lake in a rocky bowl, and while a man might climb beyond the Skookumchuck, it would be practically impossible for horses. A little farther east however a long lateral branch of Findlay rises gradually to open alpland, and a pack-train could there be taken over to Skookumchuck creek with apparent ease. We had some scrambling on brown polished rocks before reaching the snowfield, which is about 3 square miles in area; there is a short terminal bit of ice with a few open crevasses. We turned our course toward the peak rising at the south-western corner, circling to a low depression on its northerly ridge. There we saw, what we already knew, that we were a little to the east of the main watershed, above the south-west terminal fork of Findlay creek. This also emerges from a lake, one that is icy and backed by a small glacier. There is no practical pass over to St. Mary river.

Our peak afforded pleasant climbing and we stood on top at noon. There was a narrow crest of corniced snow, 200 feet long, with bits of rock outcrop at each end. The barometric elevation was 9850 feet. North of us stretched the Findlay valley, its last miles paralleling the watershed which now loomed before us. Looking along it the peaks were massed in line, Mount Findlay rising splendidly above all other peaks in the vicinity, confirming our previous opinion that it is the highest peak south of Earl Grey pass. Just to the right of it was the snowy spire of Mount Toby, now 20 miles from our vantage point. We were surprised at the southerly extent of our travel.

Of decided interest was the fact that, a little to the west, was a ridge separating the heads of St. Mary and Fry rivers, the watershed making an abrupt westerly curve between them. The southern extent of Fry river drainage is much greater than shown on any map. Beyond, in the south-eastern angle between Fry river and Kootenay lake, rise the immense pinnacles we had already observed in 1928 and 1930 from Mount Toby and Mount Findlay. Of dolomite sheerness, they are as lofty and spectacular as one could wish for. The valley of Fry river is a gateway to them, but a difficult and forbidden one.



Sketch-map of the Purcell Range and sources of the Kootenay River

Again controverting existing maps, Skookumchuck creek does not reach the watershed at any point, being pinched off by Findlay creek and St. Mary river. The latter has its principal northern sources in two frozen lakes on the southern side of our peak, which we have called Mount St. Mary. The river lies in a lush-green valley, extending southward for about 10 miles before a bend to the south-east cuts off the view of its further course. The Purcell watershed, after its westerly course between Fry and St. Mary basins, turns southward again, following the western rim of St. Mary river on the crest of lower unglaciated mountains forming the divide between St. Mary river and Kootenay lake. We had reached the southern limit of the alpine Purcells; there is little to the south to attract the mountaineer: no peak that attains 10,000 feet. Through one gap a little south of west we looked into such a low corner filled with blue that we believe it to have been a bit of Kootenay lake.

Findlay creek is one of the longest Purcell valleys that we have visited, more than 50 miles from source to mouth. Indeed, with St. Mary river in the south and Spillimacheen river in the north, which exceed it in length, it forms one of the chief eastern effluents of the Purcell system. Fry river is the largest stream draining to the West Kootenay side, and its extent to the south has not been recognized before. The approximate latitude of Mount St. Mary is 49° 57′, in the east–west line with Tornado pass in the Rockies. The United States boundary was but 65 miles south of us.

The watershed between Mount Findlay and the head of Findlay creek is 10 miles in length, although air-line distance shortens this by 2 miles. Its direction in this portion is generally south-east, in 4 miles passing over the three peaks—Midge, Lees, and Clutterbuck—bordering the lateral valley south of Findlay glacier. Mount Pambrun culminates a gigantic western spur from this portion of the divide and extends into the angle between Carney creek and Fry river.

For the next 4 miles the watershed continues over a relatively low ridge, supporting two minor peaks, and reaching Mount Klahowya. This section closes the western cirque of the lateral valley which we had reached from the fire zone in Findlay creek. From Mount Klahowya the divide runs for a further 2 miles, over a lower pointed rock peak, to reach a symmetrical snow mountain, Radiant Peak, immediately north of the south-west terminal fork of Findlay creek. It stands just opposite Mount St. Mary, with the icy lake and small glacier between. This is the last peak on the watershed approaching 10,000 feet, but does not quite reach this elevation. The watershed now makes its acute bend to the west along a much lower featureless ridge between Fry and St. Mary rivers.

A fine rock summit, Mount Nowitka, a mile west of Mount St. Mary, stands between terminal forks of the latter river but is on the East Kootenay side of the watershed. As far as we were able to determine, Mount Klahowya is the last southerly 10,000-foot peak of the Purcell watershed. There is no low crossing of the portion of the watershed between Mount Findlay and the head of St. Mary river: no pass between Findlay creek and Fry river.

In three seasons we have come to know something of the history of the region and have followed its trails from the northern tip where the Dogtooths rise above Golden to the far south, beyond the highest peaks, to the valley of St.

Watershed peaks south of Mount Findlay

The Purcell watershed, looking north from summit of Mount St. Mary

Mount Nowitka, looking west from Mount St. Mary

Canal Flats: in foreground canal built to divert Kootenay river into Columbia lake

Mary, where the range begins to sink into foothills. We have lived joyous days in these Purcell wanderings.

Note on Nomenclature

There are at present no official maps of the Purcell watershed south of Earl Grey pass and Mount Toby. Nomenclature of peaks employed in this, as well as in the preceding paper, is subject to the approval of the Geographic Board of Canada, whose policy usually is to act only when a formal survey has been made. New names appearing in this paper and their significance are as follows:

Mounts Klahowya and Nowitka—Indian names of steamers formerly voyaging on the Columbia River between Golden and Windermere.

Midge Peak—the name of Baillie-Grohman's launch which he brought to Kootenay lake in the eighties.

Mounts Lees and Clutterbuck—J. A. Lees and W. J. Clutterbuck were the authors of the first book dealing with Purcell valleys.

Radiant Peak—descriptive of its symmetrical snowy appearance.

Mount St. Mary—the highest peak between Findlay creek and the head of the river of the same name.

Canal Flats: in foreground canal built to divert Kootenay river into Columbia lake

Mount Nowitka, looking west from Mount St. Mary

JOHN ADAMS AND HIS MAP OF ENGLAND

EDWARD HEAWOOD, Librarian R.G.S.

THE complete history of the mapping of England has yet to be written, and many of its details are still obscure. The early labours of Christopher Saxton and his immediate successors had covered the field so fully that until the time of Ogilby and Seller in the third quarter of the seventeenth century —a century after Saxton—no one had thought it necessary to attempt anything better. While Ogilby's work is well known, and its value duly recognized, that of his contemporary, John Adams, has attracted far less attention, though briefly referred to by Gough in his 'British Topography,' and also in the notice of Adams in the D.N.B. Recently, his attention having been called by accident to one of Adams's maps in the British Museum, the late Mr. Henry Harries made some industrious researches on the subject, and before his death had set down the first results in an article which has been found among his papers and sent to us for perusal. In the form in which it stands it seems not quite suitable for publication, as certain facts appear to have been overlooked, rendering some of the conclusions open to question. Had Mr. Harries lived he would no doubt have modified them to some extent himself. While therefore taking his study as the basis of the present article, we have ventured to recast and extend it in certain directions.

The definite facts concerning Adams's topographical work are extremely scanty, the chief authority for them being the preface to the 'Index Villaris brought out by him in 1680, with a few gleanings from the State Papers and other contemporary records. Very little is known of the other circumstances of his life, beyond the fact that he was a barrister of the Inner Temple and, it is supposed, a civil engineer. Mr. Harries identified him with a "Johannes

Adamus Transylvanus," author of two humorous poems on London published in 1670 and 1674; but there seems no certain proof that this was the same man. The 'Index Villaris' was a very extensive catalogue of the cities, towns, and villages of England and Wales, compiled with great industry and embracing over 24,000 names, one line of print being given to each; into this small space, partly by the use of symbols, Adams contrived to compress a good deal of information, including statements of the county, hundred, or other subdivision, deanery, rateable value, and particularly the geographical coordinates to the nearest whole minute of latitude and longitude of each place in the list. The longitudes were measured east and west from London, and though Mr. Harries suggested the "London Stone" near the present Cannon Street Station as the point of origin, there is a statement on one of Adams's maps that Cornhill had been taken as the centre of the city. (In 1675 Ogilby had taken "The Standard" in Cornhill as the starting-point of his road measurements.)

In compiling this 'Index' we may suppose that Adams took as a basis 'A book of the Names of all Parishes, Market-Towns, Villages, Hamlets and Smallest Places in England and Wales,' published by Thomas Jenner in 1657 (and several times reissued) as an extension of the 'Direction for the English Traviller,' first published in 1635. Here the total number of places in England cannot have fallen very far short of that in Adams's 'Index,' the new English names in which seem to be confined mainly to small hamlets and gentlemen's seats; he added a good number of Welsh names however, none having been given by Jenner besides those in the small map and table of distances. In Jenner's book the names were arranged alphabetically by counties, and the only information given about each was the name of the Hundred in which it was situated.

In the preface to the 'Index' Adams describes the inception of his topographical labours as follows: "'Tis now about eight years since I was at Mr. Lloyd's of Llanwdra, in Shropshire, who then designing a Fishery on the Coast of Wales, I endeavored to compute what sale he might probably make in the neighbouring markets, by Projecting a Specimen, wherein making Aberdovey, a village on the Coast of Merionethshire, the first Landing place, I set down all the Markets within an hundred miles and entered the distance between them in Figures: and shortly after, coming to London, I made a Draught of all England and Wales in like manner, which being seen and approved by several knowing and judicious persons, I engraved upon Copper Plates, and finished a large Map of England, in Trinity Term, 1677, with computed and measured miles entered in Figures." That this map was actually placed on the market is confirmed by an announcement in the *Philosophical Transactions*, vol. xi/xii, no. 135, p. 886, dated 31 May 1677:

"*Advertisement:* Distances without Scale and Compass. A new large Map of England, full six foot square, wherein computed and measured miles are entered in Figures. Designed by Mr. John Adams in the Inner Temple. . . . Price ready made up Two Guineas."

In the first state of this map no geographical features had been shown, but in deference to criticism Adams rather reluctantly added the courses of the rivers on the plates. As it was impossible to insert all the villages, he had been at great pains to compile the 'Index' as a supplement to the map. He laments

the incorrectness of existing maps—still based almost solely on old models—and it is evident that in 1677 and 1680 he had little if any means of correcting them by new information, for he admits the uncertainty attaching to many of the positions assigned both in the map and Index, the figures in the latter "being fitted to the parallels and meridians of the said map."

To rectify this state of things Adams, in somewhat grandiloquent terms, professed his determination to carry out a complete new survey of the whole country, promising to finish it by 25 March 1685. Such an idea had occurred to him when bringing out his map of 1677, but he had dismissed it for the time in view of the similar work already undertaken by Morgan (Ogilby's successor as Royal Cosmographer), Seller, and others. The little progress they had made induced him however to enter the field himself. In furtherance of his plan Adams applied for support to the Royal Society, as is shown by entries in the MS. records of that body found by Mr. Harries. The first, under date 4 May 1681, runs:

"Mr. John Adams presented his proposalls about making an Actuall Survey of England by measuring the boundary line and the distances between places both in the Road and in the Straight lines by taking the Latitude and Angles of Position, designing the direction and encouragement of the Society in his undertaking.

"It was referred to Sir John Hoskins, Dr. (Plot ?), Mr. Hill, and Mr. Hooke to consider of his Proposalls against the next Meeting.

"May 18th 1681. Mr. Adams was again present about his proposalls, with a design to show the small quadrant that he had made for making short distances with perspective sights. . . . He declared that he had made trial, by setting up four lights at Greenwich, each eight inches asunder, which were not to be distinguished at London one from another, but the four lights set up at London, ten inches distance from one another, were distinguished at Greenwich by the sights of his quadrant of 50 inches radius."

It does not appear from these quotations how far Adams succeeded in securing the active support of the Royal Society. That official countenance was given to the undertaking is shown however by the issue of a Royal Order dated from Windsor 9 June 1681, which is summarized as follows in the Calendar of State Papers:

"The King to all Mayors and other officers and subjects it may concern. After reciting that John Adams has informed him that he is encouraged by several of the Council and by both the Universities to undertake a survey of England and Wales in a more perfect manner than has ever hitherto been attempted, in the performance whereof he will have occasion to make his observations from all the eminent highlands hills and steeples, for placing the cities, market-towns, parishes, villages, and private seats in their true positions; requiring them to permit him quietly and freely to go on all places necessary for such a survey, and to afford him such assistance as he shall reasonably desire, he behaving peaceably and civilly." *

*In this Royal Order Mr. Harries saw the transformation of a private enterprise into one of national importance—in fact "the genesis of the earliest official survey of the country." This is surely going too far, for Adams was not by any means the first to obtain official countenance of the kind, without which indeed extensive field work would hardly have been possible. A somewhat similar order had been made in favour of John Ogilby's survey ten years earlier.

From this it appears that Adams was certainly a man of energy and determination, and that his plans were both thorough and comprehensive. As to their execution however we are left entirely in the dark, for so far no record whatever of his further proceedings has been traced. We are thrown back mainly on the evidence of the maps produced by him (or such of them as survive), and this is far from conclusive.

We know from the advertisement in the *Phil. Trans.* of 1677 that a large map "full six feet square" was offered for sale in that year for two guineas, and from Adams's preface of 1680 we learn that in its final form with rivers added it had by then met with a considerable sale. An industrious search and inquiries by Mr. Harries failed to bring to light any such early issue, though one independent piece of evidence that it existed in 1677–78 was supplied by Mr. Snell, Librarian of the Inner Temple. Though unable to trace the map itself in that Library he pointed to a reference to it in Mr. Inderwick's Records of the Inn. It is there stated that in 1677–78 Mr. John Adams presented a copy of his map of England, and later that £10 was paid to him for it. But there was no clue to its subsequent fate, and no reference to it in any of the early catalogues of that Library. Now the map which first aroused Mr. Harries's interest in Adams, and which he found at the British Museum inserted in the 1690 issue of the 'Index Villaris,' was dedicated to Charles II, and could not therefore have been issued later than 1685. It bore the title in large letters along the upper margin "ANGLIAE TOTIUS TABULA cum distantijs notioribus ad Itinerantium usum accommodata." This being the earliest copy of any of Adams's maps preserved at the British Museum, Mr. Harries concluded that it represented a reissue of the original of 1677, and that it embodied the results of the supposed survey of 1681–85. He seems to have thought that "six feet square" was a mistake for six square feet, which would have been a fairly correct statement of the size of the 1685 (?) map if the tables of positions at the sides were included. But in view of the price asked—two guineas—this was quite unlikely seeing that at about this very time the "Quartermaster's Map"—larger and more detailed—was selling at three shillings. Moreover a far larger map, in twelve sheets, bearing the same title and according well with the terms of Adams's advertisement, was known from an issue dedicated to William III by the well-known map-seller Phillip Lea, a copy of which has been in the Society's collection since 1916. It therefore seemed probable that this large map had been first issued some years earlier, and that, following the common practice, the name of the sovereign to whom it was first dedicated had been changed in the reissue. The smaller map dedicated to Charles II would be merely a reduced version better suited to the needs and means of the general public than the more costly large map.* This conclusion was supported by the fact that the positions of places in the large map agreed exactly, so far as tested, with the coordinates assigned to them in the 'Index' of 1680, which last, as we have seen, were "fitted to the parallels and meridians of the said map" (of 1677).

*It was no uncommon practice to issue maps simultaneously in large and small format, this having been done by Phillip Lea when bringing out his edition of Saxton's big general map. Lea's reissue of Adams's map suggests the question whether the 'Index Villaris' may not have supplied the 3000 additional places shown by Lea in his edition of the Saxton map.

Adams himself had, in 1680, regretted their untrustworthiness, so that the map which retained them could hardly have been compiled after the elaborate survey supposed to have been inaugurated in 1681. This view has now been confirmed by the finding the sheets of the large map, in an earlier state than that commonly known, inserted in a copy of the 'Index' of 1680 offered by Mr. Francis Edwards. The dedication is here to Charles II, and the subsequent change of the sovereign's name, and the substitution of Lea's name for Adams's in the signature below, are the only important alterations made in the reissue, which is printed throughout from the same plates as the earlier version. (This, it may be noted, is on the same kind of paper as a large-paper copy of the 'Index' of 1680.)

The smaller map, thought by Mr. Harries to be of 1685, may perhaps be later than the big map, for the positions of some places are shifted considerably, both in the map itself and in the tables at the sides, which give the coordinates of 781 places in England and Wales; longitudes being reckoned from London as in the big map and the 'Index.'* The improvement in the figures for longitude is certainly some reason for supposing an actual survey to have been made before the publication of the smaller map. A reissue of this from the original plate, dedicated in Latin to William III in the same terms as were used in the earlier issue, bears the name of Phillip Lea, and new versions, entirely re-engraved, continued to be issued by rival map-sellers for many years.† Most of these later versions differ in no important point from the original, apart from the representation of the Isle of Man, which, placed by Adams with its axis running too nearly due north and south, is unduly inclined to the meridian in the later copies.

The above facts may help us to form some idea of the value of Adams's work, though they leave us still much in the dark. Those who have taken his claims at their face value, and have been content with a cursory examination of his large map (including the writer in the D.N.B.), have supposed this to have been really based on a careful survey in the field, but, as shown above, there is little or no justification for such a view. In 1680 Adams did claim to have made considerable use, in collecting the names of villages, etc., of the "books of the Hearth Office and other private accompts returned me from several counties," but he acknowledged that in the main he had followed the maps of his predecessors and that his information was not sufficient "for the placing in their true latitude and longitude such additional villages and private seats" as his inquiries had furnished him with. Yet the large map gave no better information, and its chief basis seems still to have been Saxton.‡

*Mr. Harries found that the alterations in the longitudes of places were but slight in Wales and south-west England, but that Cardiff and Dover were shifted 5′, Liverpool 6′ to the east; Harwich 6′, Whitehaven and Yarmouth 8′, and Newcastle and Scarborough 14′ to the west, "thus greatly reducing the original errors." But this still left Newcastle 8′ too far east, while some of the corrections made matters worse than before. Thus Yarmouth, placed 8′ too far west in the 'Index,' was shifted still 8′ farther west in the smaller map. And the whole of East Anglia (but not Kent) suffered in like manner.

†For a list of the versions so far examined, see note at the end of this article.

‡A comparison of certain parts with Saxton's and Speed's County Maps, and with Saxton's large general map, shows that some at least of the details given by Adams are

As regards the general framework some improvement is shown in the reduction of Saxton's undue westward extension of south-west England. Thus Bodmin is shifted from 4° 59′ to 4° 52′ W. (true longitude from centre of Cornhill 4° 37′), and Land's End is brought back from 6° 30′ to 6° 0′ (true, 5° 38′). Aberystwyth takes its proper position in longitude of 3° 59′ W. The authority for these corrections must be left to conjecture, but it is probable that a certain amount of astronomical work in the field had by this time shown in what general directions the older maps needed correction. Thus Ogilby in 1675 had referred to errors of Saxton due to his having adopted magnetic north in place of true north.

The real *raison d'être* of Adams's large map was, as he claimed, the graphic representation, "without scale or compass," of the distances between places. Its novelty consisted in the method of presenting the information, not in providing new data. The compiler followed Ogilby (whose 'Britannia' of 1675 preceded the map by at least two years) in giving both "computed" (*i.e.* vulgarly estimated) and "measured" distances in a good many cases, though the great majority were "computed" only. The value of these, as Ogilby allowed, was slight, as there was no knowing how they had been arrived at, and they were often less than the air-line distance in statute miles. So far as we have tested them many of Adams's measured distances seem to have been borrowed without acknowledgment from Ogilby. On the post roads he took his "computed" distances from the Post Office tables, but from what source many of the others were derived is a problem. We know of no road-books which could have supplied so many, and not a few relate to pairs of places separated by mountains or moorland with no direct communication even by rough tracks. An instance taken at random is the distance from Garstang to Clapham in Yorkshire, given as 19 miles, while the air-line distance on the map itself is 22 statute miles, and the sum of the (computed) distances by the only feasible route (by Lancaster) is 25. On the main roads the smallness of the vulgar computation might be due to the use of the old long mile (Adams himself gives the mile as 5280 feet—the statute mile), but in the case just cited it is difficult to see how vulgar computation could come in at all. Anyhow a great many of the distances given could have had little real value, and one can only regret that so much care and labour should have been bestowed on the preparation of the map with such small positive results. A minor claim to distinction is the part it may have played in popularizing the use of London as the starting-point of longitude, though Seller had used the same prime meridian a year before (1676) for his map of Herts. Earlier English maps had either shown no degree net, or started the longitude from an external point to the west. The marginal references to the squares of the grid had been used by Norden eighty years earlier, and were thus no innovation.

The map is a fine piece of engraving, in which Adams himself would seem to have borne a part ("I engraved the same upon Copper Plates"), but we find from the map itself that the lettering was by Gregory King, and the lines, ellipses, and circles (in which the distances were inscribed) were by Thomas

to be found in Saxton's County Maps only. Otherwise one might have suspected that Adams had merely copied the large map. He used a scale of 1 inch to 5′ of latitude, which is somewhat larger than that of Saxton's general map.

Burnford. A striking feature is the ornamental border embellished with peacocks and other birds.

In promising to execute a new survey of the whole country Adams seems to have had in view not a reissue of the original map in corrected form, but the preparation of new *County* maps after the model of Saxton's and Speed's; for he offered to each subscriber for one such county map a free copy of a revised version of the 'Index.' * Mr. Harries somewhat strangely regarded the twelve sheets of the large map as a fulfilment of this promise, but in view of their exact agreement with the 'Index' of 1680 this is evidently a mistake, even if they could possibly be regarded as County maps at all. Not only are we thus left in the dark as to the steps (if any) taken to prepare such county maps, but we may be justified in some scepticism about the survey itself—whether it fulfilled in any way the high pretensions made for it before it was begun. Anyhow it seems to have left no visible result unless such is to be traced in the slightly improved positions of places in the smaller map of *c.* 1685. A more positive claim to recognition rests on Adams's laborious work in compiling the 'Index,' a thing not previously attempted on any such scale.

To explain the supposed reticence of Adams as to his work on the survey, Mr. Harries had recourse to speculation, attributing it to the need to lie low during the troublous times of James II. Immediately after the accession of William III his name is found among a large party of gentlemen who obtained passports for France, apparently with a view to sport. This suggested to Mr. Harries that he thereafter gave up mapping for a more open-air life. A John Adams is also found from time to time in the records relating to the City of London Lieutenancy, in which he held a commission down to his death shortly before April 1696; and there is perhaps no reason to doubt the identity of this man with the map-maker.

Note.—In spite of its not very firm basis, Adams's map in its smaller form had an extraordinary vogue for well over a century, as is shown by the large number of reissues and pirated copies which appeared down to the end of the eighteenth century. The following list includes all the versions so far met with, but may still be incomplete.

I. *From original plate, as published by Adams*

A. First state, dedicated in Latin to Charles II. *c.* 1680?
B. Reissue by Lea with dedication in Latin to William III. *c.* 1690–1700.

II. *Re-engraved copies*

C. Copy, slightly modified, by Nicolas Visscher, Amsterdam. Sold in London by John Overton. *c.* 1685?
D. Reissue of C, with dedication in English to James II. *c.* 1686?
E. Reissue of C, with dedication in Latin to William III *c.* 1690?
F. Another version, by William Berry, dedicated in English to James II. *c.* 1686?

*Yet the later issues of the 'Index,' 1690 and 1700, were practically unchanged. Apart from the short appendices the issue of 1690 is on precisely the same paper as the first, and may even have been old stock with a new title.

G. Reissue of F, by P. Overton, J. Lenthall, and T. Taylor, with Berry's name retained, 1718.

H. Another version, dedicated by Christopher Browne to William and Mary, n.d.

I. Reissue of H, dedicated by C. Browne to Queen Anne, n.d.

J. Reissue of H, dedicated by T. Bowles to Queen Anne, with Browne's name at foot. Engraved by H. Moll. n.d.

K. Another version, sold by Geo. Willdey. No dedication. Eighteen views of towns at sides. *c.* 1720?

L. Another version, by Henry Overton. Ten views of towns (larger than Willdey's) at sides. *c.* 1725?

M. Another version, headed 'The Traveller's Guide or Ogilby's Roads epitomized.' By I. V. Kircher. With accompanying tables. Sold by H. Overton and I. Hoole. n.d.

N. Another version, by John Bowles. Arms of Bishoprics, Cities, and Deaneries at sides. 1737.

O. Another version, by Robert Sayer. Eight views of Ports at sides. *c.* 1765?

P. Another version, by I. Evans. Eight coarsely engraved views of Ports. 1794.

NOTES ON A TRAVERSE OF NORWEGIAN LAPLAND IN 1930

CHARLES ELTON

THE Oxford University Lapland Expedition 1930 was sent out by the Oxford University Exploration Club to make a traverse of Norwegian Lapland from the north to the west coasts. Eight men formed the party, the leader and organizer being John Weatherby of Magdalen College. The expedition planned to walk from the head of Porsanger Fjord, which thrusts 60 miles from North Cape southwards into Lapland, across the interior and over the watershed of Norway, down the Reisen Valley to the west coast at Sörkjosen, carrying out a biological reconnaissance on the way. This plan was successfully carried through. The total cost of the expedition was £570: roughly £71 per man for eight weeks. The main obstacles to be overcome were the transport of food and equipment for the comparatively large party (which desired to camp in the less inhabited country away from settlements) at a cost within the resources of the expedition. The hiring of pack-horses from the Lapps proved difficult and expensive. The technical details, together with full acknowledgments of help received, will be found in the 'Third Annual Report of the Exploration Club,' and in the files of the expedition. The present short paper, which is written with the consent of the leader, attempts to give some general impressions of a country which is not frequently visited by English scientists in the summer season. I should here mention that without the valuable aid of Einar Mathisen, a young Norwegian from Tromsö who volunteered to go with the expedition, the language difficulties would have held us up at many points.

The trek was carried out mainly with pack-horses, and covered a U-shaped route from Lakselv, through Karasjok and Kautokeino, out to the sea at Sörkjosen (Nordreisa). Most of this country is covered with birch-woods, except where the main range or outlying blocks of mountains rise above the lower rolling hills and valleys to form an alpine zone with dwarf birch and no trees. Northwards however, along the Porsanger Fjord, the limit of birch trees is reached (at Smörfjord on the west coast of the fjord). In the region just south of Smörfjord, near Kolvik, a short preliminary camp enabled the scientists to work out conditions near this limit. Here birches are dense in the valley bottoms, but soon thin out and give way (the limit varying greatly with local conditions of soil, exposure, etc.) to treeless upland with dwarf birch (*Betula nana*), and higher still to alpine vegetation with such plants as *Dryas octopetala* and *Silene acaulis*. In some of the more favoured regions of Lapland the birch in turn gives way to pine forests, as at Skoganvarre and Karasjok and the Reisen Valley. But the pine does not seem to grow near the coasts, being found at the heads of the long fjords and farther inland. Owing to cutting in the past it is not always easy to estimate the real natural limits of the pine, which are now carefully conserved by the Norwegian Government Forestry Department. At Lakselv, scattered trees occur in the birch woods, and a fenced plantation of flourishing young pines proved that they could grow well when neither cut nor grazed. At Nedrevand, about 10 miles south of this point, where pines first become numerous on the hillsides, there seems to be some evidence (*e.g.* the absence of any young trees or seedlings, and the presence of a few much larger old fallen trunks) that the species is not able to regenerate at the limits of its range, although it can grow there.

It is seen then that there is a north to south zonation of vegetation from North Cape to Karasjok—treeless sub-arctic vegetation, then birch woods, and finally pine forests. No spruce was seen. This zonation is of course virtually repeated on the mountains, and it was thought that the expedition would be able to pass several times through these zones, and thus be able to gain some useful general conceptions of the zonal changes in animal and plant life, during a rapid trek with short camps, carried out by a team of specialists who would cooperate in the survey. Such an ecological survey required two botanists (W. Leach and N. V. Polunin), an entomologist (J. E. Duffield), an ornithologist (T. H. Harrisson), and a mammalogist (C. Elton). J. R. Robertson came as a photographer and general assistant to the others.

The existing roads enable a party to go by car about 25 miles inland towards Karasjok. The roadhead, both here and in the Reisen Valley, is being rapidly pushed inland, and within a very few years both the main settlements of the resident Norwegian Lapps—Karasjok and Kautokeino—will be easily accessible. But it would seem that the great stretches of country between them, inhospitable for summer camping and transport, will continue for some time to be avoided by naturalists. This inland region is still comparatively isolated from excessive contact with Western civilization, and therefore has still many features attractive to the traveller. Many of the Lapps who live there probably see little of visitors except Norwegian officials. This probably applies especially to the little groups of fishing Lapps (sometimes not more than one or two families) scattered along the lakes and rivers. The national Lapp dress is still

worn by a large number of the people, and with its gorgeous red, yellow, and orange decorations, and its free-flowing eastern shapes, makes the traveller realize more than ever the sad artistic deficiencies of black trousers and bowler hats. Some wear a mixture of dress—a felt hat and a Lapp tunic and shoes, or (as seen on a reindeer-herding Lapp at Sörkjosen) complete Lapp costume and a pair of first-class prismatic field-glasses. Several of the Lapp horse drivers wore plain blue cotton overalls. The mixture of the two cultures was also interestingly shown by the Lapp postman on the Alten–Kautokeino river, who drives his river boat with an outboard motor, himself clad in traditional costume. On the whole, one gained the impression that these native stock-farmers and fishermen have shown a considerable degree of discrimination in the Western customs and inventions that they have selected. It is to be hoped that with wise control by the Government, this balance of cultures will survive the impact of motor roads and all that they bring with them.

Except on the higher hills and mountains the interior of the region that we passed through appeared to be almost uniformly covered with glacial drift—the stones and boulders being usually concealed by deposits of peat or by vegetation and old stumps of birches. This character of the ground makes marching over the faint tracks rather difficult, especially when heavy packs are being carried. In some places there are deep deposits of sand, sometimes forming bluffs where the rivers have cut through and down into them. These sandy deposits which overlie the glacial drift represent apparently a post-glacial lake system, since no signs of marine shells can be seen. The great thickness of these sand beds, often over 100 feet, and the apparent absence of any common subfossil freshwater mollusca, suggests that the lake system existed at a time when the higher sandstone mountains were still subjected to severe frost and the lake too cold to contain mollusca. These observations are admittedly of a casual nature. But travelling through northern Norway makes one realize very clearly how recent was the last glacial retreat. It was not always realized that the tourist travelling up the Norwegian coast on the mail steamer south of Bodö can see from the deck the actual surviving remnants of the Scandinavian ice-cap on the Svartisen. The rather meagre fauna of Finmark suggests that many species of animals have not yet the opportunity or time to arrive there, in other words, that there are many species which the environment could support, but which are not found there.

Round Avjovarre, Lappoluobal, and Goeidnovuoppe (in the fairly low country east of the main range of mountains) there is an area which appears (from the meteorological maps and the signs shown by the vegetation) to have a relatively low snowfall, and to be therefore probably a good deal drier in summer. Here, as at their northern limit in Porsanger Fjord, the birch trees are not very tall, and grow in open formation. A random transect taken through the woods gave twenty-two birch trees in 209 paces, about one every 28 feet. In some places the spaces between were completely covered with a dense growth of white lichens (mainly *Cladonias*) that crunched under the feet and looked and felt like crisp snow. A little digging revealed the fact that the roots of the birches turn at right angles less than a foot below the surface and run horizontally outwards to meet those of the neighbouring trees. It was interest-

ing to find that the only young seedling birches that were to be seen occurred in the open at points about equidistant from the older-established trees, where they had the greatest chance of obtaining moisture not already appropriated by their seniors.

The scientific investigations of the expedition may be dealt with briefly. The visit to Kolvik on Porsanger Fjord enabled the botanist to study the vegetation at the limit of trees, and subsequent field work on this and other problems was done at points across Lapland, forming a vegetation transect from coast to coast. The insect and other invertebrate fauna of the birch and pine woods were investigated by Duffield, who also made special collections of the insect communities round the settlements. Insects were distinctly less numerous in variety and species than one would expect from the large number of flowering plants that occur. It was rather surprising to find great patches of rosebay (*Epilobium angustifolium*) covering the grassy meadows of deserted Lapp farms near the watershed of Norway, quite near the limit of trees. A species of wasp which occurred in the more alpine regions, and looking very like the common species found at home, is much dreaded by the Lapps, and came also to be carefully avoided by us. Weatherby was stung in the temple and became very ill for an hour, with results that lasted some days; Harrisson and another member were stung and also felt considerable after-effects. The Lapp horsemen used to run as fast as they could if the horses they were leading happened to step into a wasps' nest. These nests are made sometimes on the ground, and sometimes up in birch or willow trees, and are very neatly constructed in a ball about 6 or 8 inches in diameter. The study of insects was linked with the observations on bird food made by Harrisson, who carried out at the same time a general ecological classification of the birds in different habitats, and some transects that gave an idea of the relative numbers in different areas. The birds of prey (owls, buzzards, skuas, etc.) had a special interest, owing to the fact that in 1930 there was a great abundance of small rodents in Finmark. A lemming migration was encountered in July, between Skoganvarre and Karasjok, and later on wandering individuals were met with at almost every place we visited, or were reported later to have passed through after we had left.

The results of this combined ecological survey should be of interest in linking up the work of the Oxford Spitsbergen Expeditions and the 1928 Greenland Expedition in higher latitudes with what we are beginning to know of animal communities in the heaths and in the pine woods of England. One of the most striking features of the subarctic zone is the abundance of blood-sucking insects. The commonest of course are mosquitoes, then come the medium-sized black biting flies (*Simuliidae*) and very small midges, backed up by a contingent of Tabanids and other scarcer species. A special investigation of the ecology of mosquitoes was made by Duffield and myself. The first thing we noticed was that about half the party was quite immune ordinarily to mosquito bites, while the others suffered severely at first, becoming acclimatized after a week or two. These observations suggest an interesting biological investigation into the factors responsible for such immunity. Thus, when Duffield once became acclimatized or "salted," he never suffered afterwards from bites, while I, who was ordinarily completely immune, was badly

bitten on several occasions when I was extremely tired physically. Amongst other things it was found that mosquitoes do not usually fly about and bite at temperatures below 50° F., or above 70° F., so that marching on very hot days (*e.g.* at 80° F.) had certain compensations. By simple experiments it was proved that the mosquitoes react to temperature gradients in air containing moisture, to wind of a certain speed, and to certain smells (*e.g.* wood or peat smoke). It is hoped that the construction of a climograph for some of the species of mosquito met with in Lapland may throw a little light on the geographical distribution factors which make mosquitoes so extremely abundant in the subarctic regions all round the world.

The last phase of the expedition's trek was down from the watershed into the gorge of the Reisen Valley—one of the most magnificent and wildest of places. On the top of the cliffs and screes which rise some 1000 feet from the river and run for about 40 miles down to the coast, there is upland-alpine vegetation, with lemmings, long-tailed skuas, and golden plovers. On the screes and in much of the valley bottom there is birch and pine inhabited by red-backed voles and owls. The contrast in vegetation between the bare wind-swept upland and the enclosed valley with its forest and richer vegetation is very striking. But even in this valley the winter conditions must be severe, for at Punta there could be seen regular "mud polygons"* produced by frost. Digging showed these to be composed of pure mud, and they occurred in a ring round a shallow pool on the farm meadow, where the freezing of the lower layers would produce frost-heaving in winter. The "polygons" were about 2 or 3 feet across, and would perhaps better be called hummocks, since the hexagonal arrangement was not marked owing to the softness of the ground and absence of stones. The comparative wildness of this northern country was shown by a remarkable incident which we witnessed one day on this farm at Punta. There were four small cows in the meadow, and a large dog (I think of the same breed as the German police dogs, rather like an Alsatian) ran up and began to bark at them. Instead of remaining bovine and huddling up, as English cattle would do in the same circumstances, the four small cows formed up in line and charged the dog like lightning, again and again, and chased it round the field. The explanation of this behaviour appears to be that wolves are still found in Finmark (six were killed at Mieron in the winter of 1929–30, as we were told by the Lapps), and the fighting formation of the cows had in the past a real survival value and may still have occasionally at the present day.

The traverse of Norwegian Lapland served to show us the great amount of biological work that can be done in this country by any one who places more value on the following up of scientific problems than on his personal comfort. The complete working out of the ecology of this country will require many more expeditions, and it is hoped that the experiences of the Oxford expedition in 1930 (which have been placed on record and are available for future travellers) will save others a certain amount of trouble and difficulty in organization. The scientific results are being published in various journals and will later be collected into one volume of papers, which will appear about 1934 or 1935.

* *Q.J. Geological Society*, 1927, vol. 83, pp. 163–194.

REVIEWS

EUROPE

THE ARCHAEOLOGY OF SURREY. By D. C. WHIMSTER. (The County Archaeologies. General Editor, T. D. KENDRICK.) *London: Methuen & Co.* 1931. 8×5 *inches;* xvi+254 *pages; illustrations and maps.* 10s 6d

Half a dozen of Messrs. Methuen's 'County Archaeologies' have now appeared, and the standard set by them to the series is a high one. Mr. Whimster maintains the standard. He has collected his material with care, and has handled it with judgment; the result is a readable volume, forming a convenient guide to the archaeology of Surrey. It must be confessed however that the archaeology of Surrey is a subject offering few attractions either to a writer or to a reader. The tradition of treating English topography by counties is so ancient an abuse that it is perhaps idle to protest against it; yet the fact remains that no English county forms a convenient whole to the archaeologist, and Surrey is in this respect worse than most, being a kind of backwater at the junction of several districts each having a much more definite character of its own. The best way of treating it, geographically and archaeologically, would be to regard it as the north-western frontier district of a region lying south of the Thames and east of the Hampshire basin. Further, it is impossible to write a book on the archaeology of Surrey—which, in any case, must be written for the general public; no expert wants a book on just that subject—without putting in a great deal of explanatory matter that must be repeated in other volumes of the same series: you must explain what a rostrocarinate flint is, and who the Beaker-folk were, and a single sentence mentioning Samian pottery must be followed by half a page giving an outline of its character and history. But, within these rather trying limits, Mr. Whimster has written a book which Surrey people can use with confidence as an account of the archaeological discoveries made in their county. R. G. C.

THE ARCHAEOLOGY OF SOMERSET. By D. P. DOBSON. (The County Archaeologies. General Editor, T. D. KENDRICK.) *London: Methuen & Co.* 1931. 8×5 *inches;* xvi+272 *pages; illustrations and maps.* 10s 6d

A county which includes Glastonbury, Wookey, Cheddar, Bath, Whorlebury, and Athelney cannot fail to appeal to all interested in archaeology. This work gives an account of the chief discoveries archaeological research has revealed in Somerset from Palaeolithic to Saxon times. Such an account extending over so long a time, condensed into a small volume, necessarily sometimes takes the form of a catalogue, notwithstanding the author's praiseworthy efforts to make it a readable narrative. Both the early and late Palaeolithic ages are represented in the county, but there is little evidence of the Neolithic period. There is a considerable gap between the Palaeolithic and Early Bronze Ages, and its place is taken by a chapter on Beakers and Megaliths, in which the Stanton Drew Circles and the Long Barrow of Stoney Littleton are described.

The Bronze Age is characterized by an enormous number of Barrows. The subject, as the author remarks, is immense, and only its fringe is touched. Some four hundred bronze implements have been found, including no less than seventy palstaves. The most striking ornaments are the torques, with which must be ranked a fine gold one from Yeovil. A feature of the pottery is the number of incense cups. Undoubtedly the most attractive period is the Early Iron Age, for it includes the Glastonbury Lake Village. The results of its exploration, supplemented by that of Meare, still in progress, the discoveries at Wookey Hole, and the Polden Hills find make Somerset one of the richest fields of the period in

Britain. Roman Somerset, since it includes Bath, raises expectations which are only partially realized. Professor Haverfield devoted many pages of the 'Victoria History of Somerset' to this subject, and they supply material for the author's chapter on the period, supplemented by discoveries made since it was published in 1906. The number of coins that have been found is remarkable, computed to be at least 50,000, extending over the whole period of the Roman occupation. The lead mines of Mendip, early worked by the Romans, raise interesting questions.

Saxon Somerset brings us to the border line of history and archaeology, for the county was the scene of struggles between Saxons and Britons and Danes. One would hope that archaeology may yet elucidate the vague and dim history of these times. The association of King Alfred with Athelney lends an air of romance, not diminished by the discovery of his famous jewel, one of the few Saxon remains that have come to light. A chapter is given to the numerous camps scattered over the county, so many indeed that the description of them is little more than a catalogue or, in the author's phrase, a breathless enumeration. An Archaeological Gazetteer is added, giving a detailed list of the finds with full references. It forms a valuable bibliography. The book is illustrated with maps, plates, and many woodcuts in the text. E. A. P.

IN THE HIGHLANDS. By SETON GORDON. *London: Cassell & Co.* 1931. 9×6 *inches;* x+150 *pages; illustrations.* 7*s* 6*d*

Mr. Seton Gordon has written many works on Highland scenery and Highland birds, of which he is a most competent observer and photographer. In the present volume the matter is arranged according to the season, each of the twelve chapters being devoted to a month and written round and about some particular animal or bird. This method has some advantages, but it does not make for continuity, as the narrative jumps in the most disconcerting fashion from Skye to the Cairngorms, and Loch Lagga to the Hebrides; but the observations on bird life are original and often new. The first chapter (January: the Raven's month) tells us how the raven is the earliest bird to begin nesting, and this for a practical reason; the fledgelings are fed largely upon the foetal membranes of the newly born lambs. It is therefore necessary that the young ravens should be hatched at the commencement of the lambing season.

Mr. and Mrs. Seton Gordon's skill in photography is well known and the illustrations of the present volume show that there is no falling off in this respect. W. L. S.

HOW EUROPE GREW. By F. J. ADKINS. *London: Williams & Norgate* 1931. 9×6 *inches;* 592 *pages.* 25*s*

Both the general reader and the seasoned student of history will find this a valuable book. The writer is setting forth the ripe judgments of long study. He has also had the advantage of teaching history as well as reading it; and nothing so readily exposes to its author the unsoundness of an opinion as standing up and delivering it *viva voce*, whilst his disciples can be trusted to notify him of any unsoundness in his facts. Mr. Adkins's book, so far as the reviewer can judge, is creditably free from errors of haste and inadvertence. Its style is scarcely on so high a level. It has eccentricities, especially of punctuation, which irritate at first, although one grows used to them. In spite of occasional crudity, there is no dullness, and the book keeps its reader awake by its close reasoning and wide knowledge.

In presenting the subject of Europe's growth the author does not neglect his foundations, and the treatment of Greek, Roman, and Hebrew influences is thorough and convincing. Mediaeval Christendom is well described, with due attention to its perils and escapes from the assaults of Asia, a matter too often

minimized in such accounts. The predominance of the religious motive in the life of Europe is well brought out, and is shown to continue even when the story moves into modern times. In the chapters which deal with discovery and expansion there is perhaps a falling off from the generally high standard, but even here the author's historical sense preserves him from the most serious consequences of a failing in detailed knowledge. J. A. W.

DIE LANDSCHAFT DES EUROPÄISCHEN NORDENS in ihren Übergängen von Deutschland bis Lappland. By Dr. IRMGARD DANN. (Veröffentlichungen des geographischen Instituts der Universität Königsberg i. Pr. Ausser der Reihe No. 4, 1930). 10×7 *inches;* 48 *pages*

This work is a discussion of the transition in landscape from Germany to Lapland, considered under four headings: (1) Boreal characters in the Middle-European landscape; (2) border-line landscapes; (3) the northern forest; (4) the tundra; and postulating a general succession of transitional features from south to north.

But how far can this be truly considered as a region where transitions from north to south can be typically traced? In parts of the region the gradations are clear enough, but between North Germany and Scandinavia, and between Estonia and Finland, is the Baltic.

Apart from the striking differences in the materials making up the land surfaces on each side of the sea or gulf, the disturbing influences introduced by the Baltic are sufficiently great to upset the ordinary south-to-north transitions altogether. Moreover the climatic and other contrasts seen in the south are mainly due to oceanic *versus* continental influences, coming into play transitionally from west to east, but everywhere profoundly modified by the Baltic, which acts as an inlet for oceanic climate-modifications. E. G. W.

RISORSE IDRAULICHE PER FORZA MOTRICE UTILIZZATE E ancora disponibili. Bacini del compartimento del Magistrato alle Acque. Vol. I. Adige. *Roma: Ministero dei Lavori Pubblici. Servizio Idrografico (Fasc. VII della Pubblicazione N.* 12) 1931. 10×7 *inches;* viii+134 *pages; diagrams and maps*

This Report on the hydraulic power resources of the basin of the river Adige is the seventh publication in order of issue of the twelve arranged by the Italian National Hydrographic Service to cover the whole of Italy. It has been compiled with the assistance of the Water Department (Magistrato alle Acque), which, as stated in the preface, arranged that the appropriate hydrographic bureau should undertake in relation to the standards adopted for the other regions of Italy studies and direct determinations in order to estimate the resources developed and those still available in the Venetian Basin.

After the prefatory section, which includes a general introduction by the President of the Water Department (Ing. Luigi Miliani) and an explanation of the official terms employed and of the methods of computation, there comes the main report by the Director of the Hydrographic Bureau (Ing. Niccolo Salvini) in which the physical, meteorological, and orographical features of the basin are discussed under their respective heads. Thereafter follows a tabulated collection of data in detail relating to various sections of the basin.

The purview is limited to the catchment basin of the main stream and its three principal influents, the Isarco, the Noce, and the Avisio, down as far as Albaredo, a few miles south-east of Verona. The area comprised is 11,981 square kilometres, and this is subdivided into five zones: (1) The Adige from its origin to its confluence with the Isarco (2722 sq. km.); (2) the Isarco with its tributary, the Rienza (4193 sq. km.); (3) the Adige from its confluence with the Isarco to its

confluence with the Noce (1843 sq. km.); (4) the Adige from its confluence with the Noce to Matarello and the basin of the Avisio (1224 sq. km.); (5) the Adige from Matarello to Albaredo (1999 sq. km.).

An interesting coloured map gives an allocation of the whole area under the three headings of impermeable rock, semi-impermeable rock, or rock of varying degrees of permeability, and lastly, permeable rock.

The orographic system of the region is very complex owing to numerous drastic geological disturbances. Fracture, volcanic eruption, and the secular action of ice have made a striking impression on all parts of the catchment basin. Rainfall is allocated on a coloured chart to 4 degrees of precipitation, rising by 500 mm. per annum. The maximum fall, in general, takes place during the months from May to August, with a renewal of intensity in October–November.

Of water for power, computed in terms of mean nominal horse-power, the summary gives on a coloured graph a total for the whole compartment of 2,844,840 h.p. available, and of 468,671 h.p. actually developed up to the end of the year 1929. The detailed lists at the end of the volume contain a number of interesting cases, of which one of the most important is the Cardano station, near Bolzano, which the present reviewer had an opportunity of inspecting during the concluding stages of its construction in May 1930. The capacity of the station is 270,000 h.p. This magnitude and the unusually high tension (240,000 volts) of the transmission lines makes it one of the most notable hydroelectric installations in Europe.

B. C.

LANDESKUNDE VON DEUTSCHLAND. Edited by N. KREBS. Band III. Der Südwesten. By NORBERT KREBS. Zweite Auflage. *Leipzig: B. G. Teubner* 1931. 9×6 *inches;* vi+220 *pages; illustrations and maps. M.*10

This volume is one of four dealing with Germany in course of publication under the editorship of Professor Krebs, and treats regionally of Germany approximately south of latitude 50° N. The work is well illustrated by a number of excellently chosen photographs; maps and diagrams are neither so numerous nor so complex as in some German books of this class.

In the diagram on p. 71 the regional divisions selected by the author are superimposed upon a map of structure, a procedure which might well be followed by other writers as a substitute for the more simple line diagram in common use. That natural aspects have proved the basis of the regional divisions is well illustrated by the fact that political boundaries have not been allowed to delimit any of the peripheral regions concerned; hence the Vosges is considered along with the Black Forest as part of the Waldgebirge of the Umrahmung der Rheinebene. Sound as the material is however, rather more attention might have been given to the regional aspect; one-third of the volume is devoted to general topics, leaving only 133 pages for the consideration of the regions, with such results as the appearance of a diagram of the Saar territory in the general section instead of in the appropriate regional section. It seems a great pity that a book published in 1931 should have to use 1925 statistics almost throughout. A feature of great value is the well-ordered bibliography extending to nearly six hundred references grouped according to the scheme of treatment used by the author.

H. C. K. H.

GREEK CITIES IN ITALY AND SICILY. By DAVID RANDALL-MACIVER. *Oxford: Clarendon Press* 1931. 9×6 *inches;* xii+226 *pages; illustrations and sketch-maps.* 12*s* 6*d*

This is a book to delight those who already know the region, and to tempt those who do not, to visit it. Dr. Randall-MacIver knows the country, the sites, and

the literature intimately, and has the personal friendship of men like Senator Paolo Orsi, who, however freely they write, have so much more left to tell and to show. Though it is half a century and more since Lenormant's 'La Grande Grèce,' industriously employed by Italian topographers and archaeologists, there are still large gaps in the record, especially round the shores of the Gulf of Taranto. But Dr. Randall-MacIver has made the most of what is available. Beginning with Cumae, Paestum, and Velia, he goes on into the Calabrian south, by Hipponion and Medma, Locri and Caulonia, to Croton, Sybaris, Metapontum, and Tarentum: then returns to Sicily, with a brief note on Taormina and other sites north of Syracuse. Then Syracuse itself occupies four chapters; and we pass on to Gela, and the sites of the South and West. There are some excellent photographs of sites, buildings, and characteristic antiquities. On p. 24 "site of the hill" should be "side," and on p. 45 "plinth" should be "base." Did a Carthaginian empire "stretch from Tunis to the Pyrenees" about 270 B.C.? (p. 131). And was the "more southerly route" direct from the Corinthian Gulf to Croton actually in use in Greek times? Otherwise the historical and geographical commentary is alike excellent, as was to be expected. J. L. M.

ASIA

IN BOLSHEVIK SIBERIA: the land of ice and exile. By MALCOLM BURR. *London: H. F. and G. Witherby* 1931. 9×6 *inches; 224 pages; illustrations and sketch-map.* 10*s* 6*d*

This is an interesting record of a trip to Bolshevik Siberia which the author undertook on a mission, the precise nature of which he has not disclosed, but which was apparently connected with mining. He travelled by the Trans-Siberian railway to Irkutsk and thence in a north-easterly direction to Vitim, proceeding south-east to Bodaibo, where he remained for several months before making the return journey by the same route.

Much of the country traversed is little known in the British Isles, and most of us are probably equally ignorant of the condition of the inhabitants at the present time. Mr. Burr has condensed a large amount of miscellaneous information into a small volume of 214 pages. We have no difficulty in accompanying him by rail and road, and he makes us quite familiar with the many queer types of officials and others among whom his time was spent; but in spite of having passed through many interesting and amusing experiences we must confess to a feeling of relief from anxiety for his safety when our author returns to Western civilization. The book throws much light upon Bolshevik Siberia, and the writer discusses the economic situation there prevailing with fairness and moderation. It is satisfactory to learn that Mr. Burr was well received by officials and non-officials alike throughout his visit, and that the fact of his belonging to a capitalist State on one occasion only seems to have caused any serious trouble. It is altogether a most readable book, written in an easy and pleasant style, to which excellent photographs of little-known places add an additional attraction. W. G. G.

THE IMPERIAL GAZETTEER OF INDIA. Vol. XXVI. Atlas. New (Revised) Edition, published under the authority of the Government of India. *Oxford: Clarendon Press* 1931. 9×6 *inches;* viii+66 (*plates*) *and* 42 (*index*) *pages.* 17*s* 6*d*

The original edition of the Atlas of India was published in 1909, and has been invaluable to many generations of students of India and of Indian affairs. The revised edition, now published under the authority of the Government of India, should, in these days of special interest in India, and of numerous books

published dealing with all aspects of its life and circumstances, prove even more indispensable.

The new edition contains two additional plates of maps, as well as a new map of military divisions. One of the added plates gives four new maps of agricultural products, and the other provides an additional provincial map necessitated by the redistribution of the former provinces of Bengal and of Eastern Bengal and Assam among the three present provinces of Bengal, Bihar and Orissa, and Assam.

The changes in the general maps are due to the increase of knowledge in the twenty-two years that have elapsed since the publication of the first edition.

In the geological map the distribution of the Dharwar rocks, now believed to be the oldest of the Archaean rocks, and the main source of India's metalliferous wealth, is separately indicated. The geological formations between Mount Everest and Kangchenjunga, and to the north, including Lhasa, are now shown. The geology of the Malwa plateau has been completed, and also that of Baluchistan west of the Kirthar range. The Aravallis, instead of being shown as simply Archaean, are divided between the Purana and Dharwar systems; the Bhanrer and Kaimur ranges are Lower Palaeozoic; and the Arakan Yoma and Patkoi ranges are Upper Cretaceous.

In the orographical map there has not been much opportunity for material change, but the nomenclature of the great ranges of the Himalayan system has been brought into accord with the views of the Survey of India. "Mustagh" is no longer given as an alternative for "Karakoram." Namcha Barwa, a mountain of over 25,000 feet, is shown inside the great bend of the Brahmaputra in Tibet.

In the map of "Vegetation Features" there are now four kinds of indicative colouring instead of six: "Wooded Areas" have taken the place of "Forests" and "Bush and Small Wood," and "Areas mainly under Cultivation" have taken the place of "Cultivated Lands" and "Grass or Sparsely Cultivated." The result is that Burma appears mainly as a "Wooded Area," and that the distinction between the great river valleys of the Deccan as "Cultivated Lands" and the intermediate areas as "Grass or Sparsely Cultivated" has disappeared; while patches in the Bombay Deccan are distinguished as "Grass Scrub or Steppe." The greater part of the North-West Frontier Province and of Baluchistan is included under "Grass Scrub or Steppe," instead of "Grass or Sparsely Cultivated." The meteorological maps are unchanged.

The map showing "Density of Population" gives the density by political divisions according to the Census of 1921 (not 1931) instead of by natural divisions according to the Census of 1901, which from the purely geographical point of view is no doubt for the worse. The colour scheme is changed for the better, the indications of density now ranging from "under 40 to the square mile" to "over 600" instead of from "under 100" to "over 400," which makes the new map distinctly more informative. Baluchistan is thus separated from western Rajputana by a band of higher density; and the exceptionally high densities of eastern Bengal, northern Bihar, and the north-eastern portion of the United Provinces, and also of Cochin on the Malabar Coast, are made apparent. It also brings out the progressive increase in density down the Irrawaddy basin, whereas in the old map all Burma appeared as having a density of below 100.

The maps showing the distribution of races, languages, and religions are practically unchanged. A feature of the agricultural maps is the marked reduction of areas of "no returns." Maps which did not appear in the first edition are those for barley, jute, sugar cane, ground nut, and rape and mustard. Gingelly has now been omitted. Its cultivation, like that of linseed, appears to have been stationary or declining, while that of ground nut has greatly increased.

The most important changes in the map of "Economic Minerals" are the inclusion of the new oil fields in Baluchistan, the North-West Frontier Province, and the north-western Punjab, and the representation of lead, silver, tin, copper, chromite, bauxite, monazite, and mica.

The railway maps are generally up to date, but the middle section of the Raipur-Vizagapatam line is not even shown as "projected," although the whole line is nearly complete, and will be open for traffic very shortly. The line connecting Dera Ismail Khan with Tank is not shown.

Important additions to the railway system that are shown are the line from Quetta down the Zhob valley to Fort Sandeman, which must ultimately form part of the shortest route between Quetta and Lahore; the line from Spezand south of Quetta which follows the former Quetta–Seistan trade route to Duzdab inside the Persian frontier; the south-north line across eastern Hyderabad which connects the lines from Bezwada and from Hyderabad with the Nagpur system and so saves 200 miles in the journey between Madras and northern India; the continuation of the line from Quilon to Trivandrum; and the chord from Trichinopoly which, by avoiding Dindigul and Madura, gives a shorter route to Rameswaram, and so to Ceylon, and also provides the Chetty banking community of the Ramnad District with easier access to the rest of India.

The remarkable progress in Indian Archaeology during the last twenty years is shown by the very numerous additions to the archaeological map, more especially by the indication of the prehistoric "finds" in the lower Indus valley at Mohenjodaro and elsewhere, which were not represented at all in the map of the previous edition.

The changes in the Provincial Maps are less obvious, and, apart from the additions to railways and irrigation canals, and some changes on the northern borderlands, are not material.

In the Assam map the colouring which indicates areas in political relation with India has been extended from the eastern border of Bhutan to the Namkiu range beyond Zayal Chu, the head stream of the Lohit tributary of the Brahmaputra, and labelled "Balipara" and "Sadiya" frontier tracts. A similar change of colouring has been made to cover the headwaters of the Chindwin river and the Hukawng valley in Burma, and also a small area in the undefined northern frontierland east of the Namkiu range. South of this region Fort Hertz has been marked, and the head streams of the Irrawaddy are now unconjecturally shown. In the maps of Bengal and Nepal there are some changes in the Himalayan geography. Gaurisankar is no longer confused with Mount Everest, and Makalu has been added. But why should Gosainthan, a 26,000-foot mountain, have been omitted, while the less high Dayabang remains? The spelling "Kinchinjunga" is retained throughout, though in the orographical map of the older edition it was exceptionally spelt "Kanchanganga." The Survey of India now spell the name "Kanchenjunga"; but Kangchenjunga is probably the best form.

In the United Provinces map the course of the Sutlej is not connected up with the Mansarowar Lakes, although in the map of Nepal it is. The Shipki pass, an important ethnological divide, is now marked, but not the great mountain Leo Pargial, of the Zaskar range, which overlooks it. Gurla Mandhata, over 25,000 feet in the Ladakh range, is added; also Api and Sarpol, both over 23,000 feet, in the Great Himalaya. "Karnali" takes the place of "Kauriala" as the name of the great river which eventually becomes the Gogra, the largest of the Ganges head streams.

In the map of the North-West Frontier Province and Kashmir the Zogi La, the most important trade pass over the Great Himalaya, the Kilik Pass leading from the head of the Hunza–Nagar valley to the Pamirs, and Tirich Mir, due

north of Chitral, the highest point of the Hindu Kush, are not marked. The conventional sign for a pass to which the name "Gomal" is attached seems considerably south of its real position.

It is difficult to produce a large collection of maps such as this without oversights and inconsistencies; things once in are apt to stay in, and things left out find it difficult to get in.

Finally, the town plans show much urban development in Calcutta and Bombay; the new harbour extensions of Bombay are shown; and New Delhi has been added to the plan of Delhi. W. H. A. W.

THE CLIMATE OF JAPAN. By T. OKADA. *Tokyo: The Central Meteorological Observatory* 1931. 12×9 *inches;* 4+328+10+35 *pages; diagrams and maps*

Originally designed as a new edition of Dr. K. Nakamura's 'Climate of Japan,' published by the same institution in 1893 and long since out of print, the present work came, by reason of the wealth of new material at hand, to be written entirely anew. It is based on data from one hundred and fifty odd stations from every part of the empire, and is divided into three parts: I. Climatography, being a regional description; II. Climatology, a discussion of the meteorological elements; and III. Tables. In addition there are thirty-five clearly produced plates of diagrams and maps, though the latter might have been improved by a few place-names for the reader to get his bearings by.

Japan is a striking example of a country insular in geographical position with certain oceanic features of climate possessing a climate which is, nevertheless, fundamentally continental. This is because the Japanese islands lie off the great land-mass of Asia whose monsoonal influences override local factors to a large extent. Thus in winter the cold of the continent is brought to Japan by the persistent north-west winds, whilst in summer the indraught towards Asia maintains hot and steamy south or south-east winds from the Pacific. In January the west coast is considerably colder than the east, and the mean temperature ranges from 50° F. in the south of Kyushu to 15° F. in the interior of Hokkaido. In July the distribution of temperature is much more uniform in latitude and longitude. Then Kyushu and the Ryukyu isles at 80° F. are as hot as southern Spain, and even the interior of Hokkaido is up to 70° F., though the Kurile Isles are down to 55° F., experiencing, that is to say, in a latitude not much above the 45th parallel the sub-arctic chilliness of the far north of Scotland. In winter the persistent bitter winds from Asia, picking up moisture from the relatively warm water of the Japan Sea and meeting the mountains of Japan, bring an immense snowfall to the north and west of the country. This feature of the climate of Japan is emphasized throughout the book, but it is curious that in the discussion of the rainfall there is practically no reference to the summer thunderstorms as such.

The pages are enlivened in several places by reference to the beauty of Nature, and we are told that those who have never seen the maple leaves of a Japanese autumn cannot possibly imagine the beauty of the spectacle. L. C. W. B.

BRONNEN TOT DE GESCHIEDENIS DER OOSTINDISCHE COMpagnie in Perzië. Edited by H. DUNLOP. Eerste Deel 1611–1638. (Rijks Geschiedkundige Publicatiën, 72.) *'s-Gravenhage: Martinus Nijhoff* 1930. 11×7 *inches;* xcvii+850 *pages*

The work undertaken by Mr. H. Dunlop, of which this is the first volume, will do for the Dutch East India Company in Persia the same service as the 'English Factories in India,' edited by Sir William Foster, has done for the English company. The appearance of this volume is therefore worthy of note, though it is

impossible here to deal adequately with its contents. The documents printed in full herein, now preserved in the "Algemeen Rijksarchief," consist of the correspondence which passed between the Company and its officials in Persia, capitulations concluded with the Shah, balance sheets, sailing directions, and other miscellaneous papers, the whole thoroughly annotated and provided with a glossary.

The general introduction by the editor will be of greater interest to all except close students of the history of the commercial relations between Persia and Western Europe. The early history of the Dutch company presents many similarities with that of its English counterpart. Still engaged in war with Spain for their very existence, uncertain of the outcome of the new venture, and unwilling to dissipate their military or economic power, the Dutch deliberately gave a tentative form to the company founded in 1602. Through the ignorance of the conditions to be encountered, the early voyages were almost exploratory, so that the intention to treat each as a self-contained venture and to establish no permanent factories is comprehensible. But the growth of competition and other economic forces soon compelled the abandonment of these principles, and by 1623 there were more than twenty Dutch factories in Asia, excluding Persia. The beginning of official negotiations with that country dates from 1611. An English representative reached Persia from Surat in 1614, seeking a more promising market for the Devonshire "kersies" and Norwich "stuff," unsuited to the Indian climate. This was a development of the rivalry, which was spreading in Southern Asia, for the position previously held by Portugal. At first attempts to conclude agreements between Holland and England were successful, as their interests at home coincided, but finally commercial rivalry proved the stronger, and the feeling of enmity was strengthened by the massacre at Amboyna in 1623.

Another interesting section of the introduction surveys the relations between Persia and the west prior to the arrival of the Dutch, and there is a sketch of Persian history. G. R. C.

AFRICA

NIGERIAN SKETCHES. By E. F. G. Haig. *London: George Allen and Unwin* 1931. 8×5 *inches; 252 pages.* 6s

This is neither a book of travel nor a study of Southern Nigeria and its peoples, but a collection of scattered stories written from the point of view of a junior administrative officer, which perhaps leaves a more vivid impression on the mind than does many a more serious volume.

Of the forty-one short word-pictures none is more than ten pages in length, many less than half that number. Some depict the everyday life of an administrative officer and his wife among the inevitable discomforts of the tropical outskirts of civilization, while others tell weird tales of native beliefs, superstitions, and jujus. Perhaps only those who knew the African native as he was, rather than as he usually is to-day, can fully credit the voluntary self-hanging of the delinquent in "Justice," but none can fail to hear in his imagination the prolonged grating of the needle, when the gramophone has played to a finish Chopin's "Funeral March" (which gives the sketch its name), prolonged because the hand that set it going has been stilled in death.

Human tragedy and humour follow each other closely. But the wild animals that inhabit the plains and forests find their place as well in the Nigerian picture. There is a queer charm about the descriptions of the monkeys in "The Descent of Man" that, aloft in the grey boughs of the cotton tree outlined against the sky "stayed there gambolling, the soft grey and fawn of their coats hardly to be dis-

tinguished for the dazzle of the blue that framed them. They were lyrically graceful, with the fresh, unhampered quality of a chorus from Sophocles: when they moved they moved with the clean rhythm of the sandpiper in flight, and when they stood, they stood like a sea-wave caught and gorgonized to a joy for ever as it curves over to the break."

It was worth collecting these stories together, most of which had been printed in the pages of the *Manchester Guardian*, *West Africa*, and the *Nigerian Journal*.

E. W. N.

PARERGON: or Eddies in Equatoria. By Captain JOHN YARDLEY. *London and Toronto: J. M. Dent & Sons* 1931. 9×6 *inches;* x+284 *pages; illustrations and map.* 10*s* 6*d*

One hears very little from that remote corner of Africa where the Sudan and Kenya meet the borders of Abyssinia, nor of the work being done by British officers in lonely outposts protecting the long miles of frontier against raiders from Abyssinia. Captain Yardley's book is welcome, for it tells the story of an early expedition organized by the Sudan, Kenya, and Uganda Governments in 1917 to try to put an end to these raids into British territory by armed troops of a nation with whom we were at peace, when all available British or Native troops were required elsewhere. His book gives a very clear and readable account of the trials and vicissitudes encountered on this expedition.

The movement of people in Africa is always an interesting problem, and a study of the problem which arose out of the drought of 1928 by the migration of cattle-owning people in search of water might throw light on other problems of migration; we know too that the villains of one isolated story are often vindicated when we know more about the tribes, and find out that the principal reason for their raiding was to recover cattle previously raided from them.

Captain Yardley's book makes a good foundation, and it is to be hoped that it will inspire some one to write the subsequent story, for Africa does not stand still, and the work did not end where Captain Yardley leaves off telling his story. Such a book might not be quite so full of incident, but it ought to establish the fact that the Governments concerned have done a great deal to protect their indigenous populations from free-lance raiders. The mere fact that a large number of Swahili outlaws in 1928 surrendered to the Sudan Government because it was not worth while going on shows that the work of the patrols has been efficient and not ineffective.

E. B. H.

A WAYFARER IN NORTH AFRICA: Tunisia and Algeria. By FLETCHER ALLEN. *London: Methuen & Co.* 1931. 8×5 *inches;* xiv+244 *pages; illustrations and sketch-map.* 7*s* 6*d*

There are three kinds of light travel book: one written vividly for the reader who stays at home, another that sets out facts for the traveller, and a third that combines the two. 'A Wayfarer in Africa' comes in the second category, and its value may perhaps be best judged by one who carries it in his luggage. He will find advice about railways, motors, hotels, good water supplies, etc.; hints for photographers and repeated assurances of safety. In it the chief towns and districts of Algeria and Tunisia are described (the North Africa of the volume not extending beyond these two parts of the French African Empire), and a map is included drawn by Mr. Frank Adams. But as the author's route is unfortunately not indicated on the map, and as much of the text is impersonal, it is hard always to be sure whether the places mentioned have been personally visited or not. Take, for instance, the pages dealing with M'zab, "the land of the Mozabites."

There is a good deal of information about the Touaregs, but the itinerary does

not extend to the Hoggar, and the map's southern boundary (and therefore presumably the journey's edge) is just south of El Golea. And the emphatic assurances as to the perfect safety of the Sahara where "a child might travel in comfort . . . straight down to Timbuktu" and on the way "take tea with the veiled Touaregs," seeing that "the Sahara is safer than Chicago," seem somehow to lack point and authority, as the author does not take the traveller beyond the oases on the desert's northern edge, and barely within sight of the quite waterless Sahara.

Besides descriptions of famous old Roman cities and notes on the best-known towns of to-day, there are pages on less-known spots such as Hadègе, "the home of the Troglodytes," Djerba, "too magical to be true"; Sbeitla, which will one day, the reader is told, eclipse Timgad, Dougga, and Djemila, and the oases of El Wed, Wargla, and Touggourt (to follow the author in using the French spellings of place-names). There are a score of photographs by the author, and a half-dozen reproduced by permission of the Photographic Service of the Government of Algeria, to which Department as well as to other Departments due acknowledgment is made for material both historical and topographical. A short index completes the volume. E. W. N.

THE STONE AGE CULTURES OF KENYA COLONY. By L. S. B. LEAKEY. *Cambridge: University Press* 1931. 10×7 *inches;* xiv+288 *pages; illustrations and maps.* 25*s*

It is quite impossible in a short review to do justice to this most important volume, even though it deals with only a portion of the material discovered in two seasons' work by Mr. Leakey and the members of his expedition. It is in fact an account of the sequence of the Stone Age cultures as at present recognized in the Kenya highlands, with a detailed description of the implements of each period, the whole cemented by a study of climatic changes as deduced from geological considerations and especially from the varying levels of the lakes. The human remains and detailed account of the sites are left for future publication.

Apart from descriptions and drawings of the types of implements, excellently carried out (though nothing short of a coloured plate could do justice to the beauty of some of the obsidian ovates of St. Acheul type), the heart of the volume is constituted by a discussion of the succession of dry and pluvial periods from the Chellean to Mesolithic, or later, as seen against the background of culture sequence and glacial episodes established for the west of Europe. Premising that Mr. Leakey has named the cultures and industries he found in Kenya after their European equivalents whenever possible, and, where no European exists, then after their South African equivalent but with the word "Kenya" prefixed, the most practical way of summarizing his results—and indeed the only way to do justice to his volume—would be to reproduce his table of sequences given on p. 33, which correlates climatic and culture phases. Since this is impossible, some of the more easily isolated facts may be recorded.

The first thing that strikes the reader is that in only a few instances has it been necessary to invent new names, *i.e.* the greater number of cultures and industries are actually or nearly the equivalent of those previously known.

In deposits regarded as Upper Aurignacian were found red ochre, bone awls, beads of ostrich egg-shell and ivory, pottery, and human remains (*H. sapiens*), which Mr. Leakey suggests may be related to the Oldoway skeleton found in northern Tanganyika Territory in 1913. There is probably a considerable period between Aurignacian and Elmenteitan, the latter being regarded as Mesolithic with bone awls (rare), and "enormous quantities" of potsherds, including a large variety of rim types, and to this period belong the Elmenteita skeletons. The

Gumban and Njoroan cultures are considered Neolithic, with pottery, stone bowls, mortars, and grinding stones in the Gumban and polished stone axes in the Njoroan. To the Gumban belong the highly contracted Nakuru burials, already tolerably well known in this country. It may be added that neither the Gumban skulls (previously called Nakuru) nor the older Elmenteitan are Negro; they may well be Hamitic, with perhaps an infusion of negro blood. C. G. S.

NORTH AMERICA

THE GREAT PLAINS. By WALTER PRESCOTT WEBB. *Boston and London: Ginn & Co.* 1931. 9×6 *inches;* xvi+526 *pages; illustrations and maps.* 21*s*

Professor Webb has given us in this volume an exhaustive study of the Great Plains area of the United States, most of the region lying west of the ninety-eighth meridian. One sentence from the Introduction may perhaps make the limitation of his subject clear: "East of the Mississippi civilization stood on three legs—land, water, and timber; west of the Mississippi . . . civilization stood on one leg—land." After a description of the physical characteristics, climate, plant and animal life of the Great Plains there is an interesting chapter on the Indian tribes who inhabited, and still to some extent inhabit, various parts. Of these no less than eighty tribes were once known. The Spanish approach from the South and the American approach from the East are next recounted, and the difficulties of the pioneers in making the California and Santa Fé trails are well told.

The remaining half of the book is the story of the gradual settlement of the Plains. It is strange to think that up to 1850 or 1860 the whole district was marked "Great American Desert—unexplored." But from 1865 to the present day development has been proceeding rapidly. The cattle ranch industry, coming originally from Texas, has grown yearly in importance; farther west irrigation has made the "desert blossom as a rose." Difficulties, natural and legal, have had to be contended with; questions of transportation and fencing to be considered; above all, in the more arid districts water has been a perplexing problem. Side by side with the main subject Professor Webb has dealt with such subjects as the wild horses, which he considers are descendants of the horses introduced by the Spaniards at the invasion of Mexico; the development of the six-shooter Colt revolver; the windmill, so necessary in the dry lands; the reform of the Homestead and Water Laws, which completely broke down under the difficult conditions of life in the Great Plains. There is much about cowboys, and an interesting essay on the literature of the West.

After each chapter a bibliography of works consulted is mentioned; no one can question the thoroughness with which Professor Webb has undertaken this task. Though necessarily technical in certain portions, the book carries the reader on with unabated interest. It is a mine of information, and must remain as a valuable contribution to our knowledge of the Western American States.

A. W. S.

THE RAINBOW CANYONS. By EIVIND T. SCOYEN and FRANK J. TAYLOR. *California: Stanford University Press; and London: Humphrey Milford* 1931. 9×6 *inches;* x+106 *pages; illustrations and sketch-map.* 9*s*

This is an admirably concise and comprehensive account of the very interesting region in the state of Utah, famous for its "Rainbow Canyons." Though known to explorers since Joseph Black, the Mormon pioneer, first described its glories in the sixties, it is only of recent years that this district has been thoroughly explored and its beauties made accessible to the ordinary traveller. Only in

1919 was Zion Canyon proclaimed a National Park, followed in 1923 by Bryce Canyon. To this day the railroad extends only to Cedar City, but excellent roads, such as the Mount Carmel Highway, and the facilities offered by the Utah Park Company, which maintains a series of excellent lodges, make the expedition easy.

The writers are well acquainted with the history and topography of the region, and give excellent descriptions of the two great canyons, as well as of Bright Angel Canyon, a side chasm of the well-known Grand Canyon of Arizona, and Cedar Breaks, a striking "circle of painted cliffs." The wonderful Natural Bridges and other National Monuments are enumerated, and practical suggestions as to a holiday in Southern Utah form a fitting conclusion. Indeed it is a wonder how so much information has been compressed into a modest hundred pages of not too closely printed type. The illustrations are excellent and well chosen. A. W. S.

AUSTRALASIA AND PACIFIC

AUSTRALIA AND NEW ZEALAND, with Pacific Islands and Antarctica. By L. S. SUGGATE. (Harrap's New Geographical Series. General Editor, R. N. RUDMOSE BROWN.) *London: George G. Harrap & Co.* 1931. 8×5 *inches;* 440 *pages; illustrations and maps.* 6*s*

A geographical text-book may be in the nature either of a compilation or of a creative work. It may present an array of information as an end in itself, or it may select material for the purpose of illustrating principles or of building up descriptive pictures of the landscape. Mr. Suggate's book on Australia and New Zealand is mainly, but not entirely, of the former class. It contains a great deal of information carefully recorded in text matter supported by numerous sketch-maps and photographic illustrations; and the simpler principles of economic geography are employed to supply some kind of connecting thread. Yet on the whole the book is too encyclopaedic in form: no one can be expected to remember all this detail, some of which ought to be transferred to Appendix tables. The economic geography of Australia and New Zealand is in any case rather featureless, and requires much selective emphasis to make it live. With regard to special points in the treatment, the book assumes a fuller knowledge of the significance of geological terms than young students are likely to have, and is not free from repetition either in close sequence as on pp. 89 and 91, or as a result of duplications in the accounts first of Australia and later of its political sub-divisions. The material is in general very accurate, but the wording of statements is sometimes such as to be slightly misleading, *e.g.* the reference to phormium, on p. 321.

Mr. Suggate has however written a book that will fill a gap. He has brought together in reasonable space much detail about the physical and economic conditions of these new countries, into which he has woven the summarized results of research workers on the spot. E. W. S.

PARADISE QUEST: A Naturalist's experiences in New Guinea. By LEE S. CRANDALL. *New York and London: Charles Scribner's Sons* 1931. 9×6 *inches;* xviii+226 *pages; illustrations.* 10*s* 6*d*

The author of this work is the Curator of Birds in the New York Zoological Park at Bronx and a well-known ornithologist and writer. In 1928 he obtained the consent of the New York Zoological Society to make an expedition to New Guinea in order to secure for the Park a collection of live birds, and especially Birds of Paradise, from that island. He was able to enlist the assistance in Sydney of Mr. John Ward, who has had much experience in the collecting of live birds; and together they proceeded to New Guinea and formed a base on

Yule Island, the nearest point to the Owen Stanley Range, where a large number of Birds of Paradise are found. Here they formed camps at several native villages both in the plains and in the hills, and by means of barter with the Papuan tribes were able to secure a fine collection of some forty Birds of Paradise and two hundred other birds which were safely transported to Sydney and thence back to New York.

Mr. Crandall's narrative, which is written in a very pleasing and unassuming style, contains much of interest in regard to the native Papuans on whom he was entirely dependent for transport and food. Although he had a good many difficulties in obtaining carriers and on several occasions was deserted by a portion of his followers, he gives the Papuans a good name for honesty and faithfulness. These people are divided up into villages which are not as a rule at all friendly with each other and often speak dialects quite unintelligible to each other. This greatly increases the difficulties of travel and intercourse. They have no organized system of chiefs, but in each village a so-called policeman is appointed by the Government, who is held responsible for the good behaviour of the inhabitants; apart from this, the Papuans for the most part appear to be in much the same state of civilization as they were when they first came in contact with Europeans.

The Birds of Paradise were snared by the Papuans either at their "dancing places" when they assemble in considerable numbers for the purpose of display, or at certain trees when the fruits are ripe. Here they can easily be secured, and it was most remarkable how tame they became as soon as they were caught and brought in to the camps. They would feed at once while still in the hand and there was no apparent difficulty in accustoming them to captivity.

In two respects only does the work fall short: there is no index, and—which is more serious—no map of any sort. On the other hand, there is at the beginning a list of the birds mentioned in the text with their English and scientific names as well as in most cases those used by the Papuans. W. L. S.

PHYSICAL AND BIOLOGICAL GEOGRAPHY

APPLIED GEOPHYSICS. By Captain H. Shaw. *London: Science Museum (H.M. Stationery Office)* 1931. 9×6 *inches;* 100 *pages; illustrations.* 2*s*

The sub-title of this book describes it as "a brief survey of the development of apparatus and methods employed in the investigation of subterranean structural conditions and the location of mineral deposits." It is this survey which gives it the great value for the ordinary reader, though it is essentially an introduction to the second half of the book, which is a catalogue of the geophysical apparatus and maps and diagrams of surveys in various parts of the world, collected in the Science Museum at South Kensington.

Many students have learnt that the catalogues and guides issued by the great museums of London are often more valuable than text-books issued at ten times the price, and this is no exception. Any one desiring a clear account of the methods and principles of geophysical surveying, together with a history of their development, but without the detailed calculations by which the results of a survey are worked out and interpreted, will find here everything needed, expressed in the simplest language that the subject allows.

The usual objects of a geophysical survey, the essential and the more favourable conditions for its employment, and the limitations are stated in the introduction, and then follow the descriptions of methods under four heads: magnetic, gravitational, seismic, and electric. The two former are grouped as natural, the two latter as artificial; all depend on differences in the natural physical properties

of the underground body to be investigated and its surroundings, but the effect of the differences is measured under natural and artificial conditions respectively. In the seismic method the observer does not wait for the occurrence of a natural earthquake, but produces a shock at the required moment by the use of an explosive; in the electric a current is applied and the effects studied.

The beginnings of the magnetic method are traced to De Castro, who first suggested, early in the seventeenth century, that anomalies in the Earth's magnetic field might be due to the presence of hidden bodies of magnetic ore; by the end of that century large deposits of iron ore had been discovered by this means in Sweden. The practical application of gravity methods is of much more recent date. In 1888 Baron Roland von Eötvös invented the instrument known by his name, which first made possible measurements of the necessary exactitude; but it was not till 1918 that the boundary of a deposit of salt was delineated by its means. So rapid has progress been since that date that gravity surveys have already been used for locating economic deposits in almost every country of the world, more particularly the salt domes associated with petroleum in many oil fields.

The picture on the cover of the book of a Chinese instrument, Choko's seismoscope of A.D. 136, is a fitting prelude to the history of seismic methods; it was designed to show the direction in which an earthquake was located, as well as recording its occurrence. It would be interesting to know whether it serves its purpose at the present day. It is however a far cry from this primitive instrument to those used to indicate the differences in the rate of propagation of the waves resulting from the explosion of a charge as they pass through rocks of varying elasticity. The method may be said to date from 1914, but the subsequent development has mostly been in the hands of companies producing each its own instrument and tending to keep the information gained to themselves. The same applies also to the electric methods, and the publication of such a book as this, or the more elaborate report on the Australian experiments ('Principles and Practice of Geophysical Surveying,' Camb. Univ. Press), is a welcome sign that secrecy is being abandoned; the pooling of experience may lead to rapid improvement in technique and methods of interpretation. Electrical surveys have mostly been used to trace mineral deposits at comparatively shallow depths, down to about 1000 feet from the surface, whereas gravity methods have been successful to 6000 and seismic to 7500 feet, or roughly the limit to which economic deposits can be worked in depth.

The catalogue of exhibits will mainly be of use to visitors to the Science Museum; but it would be an advantage to all if those items which are shown in the illustrations had references to the plates, as well as *vice versa*. The value of the book could be greatly increased at a small increase of cost if a diagram of an actual survey by each method and of the interpretation were introduced: for instance, the magnetic and gravitational traverses of the Swynnerton Dyke by the Geological Survey; in the latter method the comparison of the theoretical gradient for an inclined dyke with the curve experimentally obtained would help the non-expert reader to understand the subject far more than do the photographs of a torsion balance. Incidentally it is perhaps premature to say that the Geological Survey "has applied the gravitational and magnetic methods to a number of geological problems in this country"; the main object of the Survey has been to test the methods, and problems were selected where the answer was approximately known from geological evidence. One such test diagram and one or two surveys that have actually led to discoveries of previously unknown deposits of economic value would show clearly that geophysical surveying is of practical importance as well as of scientific interest. C. N. B.

THE TIDAL FORCE. A Study in Geophysics. By OTTO PETTERSSON. *Geografiska Annaler* 1930, *pages* 261–322. 10×7 *inches; diagrams*

The main idea of this paper is that the vertical component of the attractive force of the sun and moon on the sea has a dominant effect in certain tidal phenomena. Theoretical workers habitually neglect this force, and also the vertical component of acceleration in the equation of vertical motion. This procedure is equivalent to saying that the variation of pressure with time is independent of the depth. When this assumption is made in the two equations of horizontal motion, they, with the equation of continuity, are sufficient to determine the three unknowns, namely the two components of horizontal velocity and the elevation of the free surface. Dr. Pettersson is quite candid about the fundamental opposition between himself and all other workers on the subject, but unfortunately his examination of the legitimacy of the assumption he is attacking is very unsatisfactory. It is shown in all works on hydrodynamics that the approximation given is a good one, subject to a definite condition, namely that the wave length is long compared with the depth; in these conditions accurate solutions obtained with full allowance for the vertical acceleration reduce to the usual approximate solution. For waves on water it is valid if the depth is small compared with the distance a body would fall under gravity during the period of the wave. This is true in all tidal waves, but not for surface waves produced by wind; for the latter the accurate solution is needed.

The longer the period of the wave, for a given depth of water, the better the approximation. Professor Pettersson appears to think the opposite; he says (p. 285) that the small vertical force producing an acceleration a will give a displacement $\frac{1}{2}at^2$ in time t. But this is a false analogy; obviously it cannot produce such a displacement at the bottom, otherwise it would have to pull the liquid up bodily, leaving a vacuum, or else push it through the floor, according to the sign of a. The vertical displacement at the bottom is zero, and that at any other depth can arise only through the supply or removal of new fluid by horizontal movement. The separate discussion of the effect of the vertical force is illegitimate; actually a very small fraction of it goes to produce acceleration, the rest being taken up by the vertical gradient of pressure. Provided the depth is small this is consistent with the statement that the variation of pressure with time is the same at all depths below the mean surface, because the difference between the variations at different depths is small compared with the variation due to elevation of the free surface, which applies to every depth equally.

Actually, in most of Professor Pettersson's applications he is dealing with waves at the interface between two layers of water of different salinities and therefore densities. In this case there are two different velocities for long waves. One is nearly the usual velocity on a single layer of the same total depth. The other is smaller, and corresponds to waves at the interface, leaving the free surface nearly undisturbed. The condition for the neglect of the vertical acceleration is still that the wave length is small compared with the depth. The wave velocity c is then given by the formula:

$$c^2=g\frac{\rho-\rho'}{\rho}\frac{hh'}{h+h'}$$

where g is gravity, ρ and ρ' are the densities of the lower and upper layers, and h and h' their depths. For a period T the wave length is cT, and the approximation holds provided this is large compared with $h+h'$. It may therefore cease to hold if $\rho-\rho'$ is very small, and to this extent Professor Pettersson is qualitatively justified. But for a semi-diurnal wave in two superposed layers, each of depth

50 metres, it is still true till $(\rho - \rho')/\rho$ is of the order 10^{-8}, so that the usual approximation is correct except for differences of salinity or temperature so small that they would never be noticed.

There is some consideration of long-period movements, running up to 186 years; but there is no proof that any of them is actually present in the tidal force, and without such proof we cannot infer that the tide will contain any components at all with such periods. A warning may also be uttered against postulating unlimited resonance in the ocean. It is a highly dissipative system, the energy in the tide at any instant being dissipated by friction in an interval of the order of a day. In such a system there can be no high magnification of long-period tides, however accurately the periods may be adjusted.

There is much observational material in the paper, relating largely to the author's own observations of the oscillations of the water in the Norwegian fjords. This should yield valuable results to a correct theoretical treatment.

H. J.

PRINCIPLES OF STRUCTURAL GEOLOGY. By CHARLES MERRICK NEVIN. *New York: John Wiley & Sons (London: Chapman & Hall)* 1931. 9×6 *inches;* xii+304 *pages; illustrations.* 17*s* 6*d*

This book is intended primarily for the geological student. Its aim is to help him to understand the real significance of the deformations observed in the Earth's crust. The first two chapters deal with the physical properties of rocks so far as they are important in this connection, and with the effects of stress. Then follows a careful analysis of the different types of deformation, under the headings flexures, faults, joints, cleavage, structures in unconsolidated sediments. This occupies nearly two-thirds of the whole book and is very well done; the treatment is clear and the reader is helped by many excellent explanatory diagrams. The chief omission is that there is scarcely any reference to the deformations caused by igneous intrusions, a matter that seems to require a chapter to itself. It might well take the place of the chapter on the influence of rock-structure upon topography, a subject which is connected with structural geology but is not a part of it.

The remainder of the book deals briefly with broader and more speculative questions concerning the Earth as a whole, and calls for no special comment. One of the statements in the first chapter should be modified in subsequent editions. It is there said that amorphous substances will yield *continuously* to an applied tangential or shearing stress, *however small*—the italics are in the original. In this extreme form the assertion is not borne out either by experiment or by observation, and it does not apply to the substances which Dr. Harold Jeffreys calls duro-vitreous.

P. L.

THE STUDY OF ROCKS. By S. J. SHAND. *London: Thomas Murby & Co.* 1931. 8×5 *inches;* xii+224 *pages; diagram.* 6*s*

This book is meant as a not too detailed work for students of geology, but its matter is so well presented that it will appeal more widely to all those interested in rocks. Professor Shand rightly insists on the importance of field-work, and on the end to which all petrological work is directed. A rapid review of the modes of occurrence of Eruptive (Igneous) rocks, and of the chief mineral families contributing to them, is followed by summaries of the main classifications that have been proposed for them, together with reasons for their rejection by the author. Naturally, he follows his own well-known classification, and divides them into three classes: Over-saturated, Saturated, and Under-saturated (the last with two divisions), depending on the occurrence of minerals stable (saturated minerals)

and unstable (unsaturated) in the presence of free silica. Further sub-division is made on the relation between alumina and the alkalis and lime, on the texture, on the ratio of light to heavy minerals, and on the composition of the felspars. In dealing with the various classes, illustrations are drawn from occurrences all over the world.

The Eruptive rocks receive the most attention, and rather more than half the book is devoted to them. The section dealing with the Sedimentary rocks is somewhat brief, and some of them receive only a short notice. One looks in vain for a mention of the Growth-in-Place Theory (the Drift Theory is indirectly stated) of the origin of coal, a short discussion of the formation of which would not have been out of place. The Metamorphic rocks are dealt with in even less space, including an account of their special minerals and a summary of the chief attempts at their classification. The author, for the purposes of the book, classes them simply as Mylonites or rocks which have been metamorphosed by crushing without recrystallization, Hornstones or rocks which have been recrystallized by the action of heat, and Crystalline Schists or rocks which have been recrystallized under pressure. The last-named are sub-divided on a chemical basis depending on the ratio of alumina to bases in the characteristic minerals present. The illustrative examples are well chosen. A pleasing feature of the book is the short list of "suggestions for reading" at the end of the chapters, and the Appendix on rock-analysis. To Professor Shand, a rock is something demanding a sympathetic study, and his mode of handling his subject makes the book very readable.

H. D. T.

VERGLEICHENDE LANDSCHAFTSKUNDE. By SIEGFRIED PASSARGE. Heft 5. Der Mensch im heissen Gürtel. *Berlin: Dietrich Reimer/Ernst Vohsen* 1930. 10×7 *inches;* viii+216 *pages.*

This concluding volume of Professor Passarge's *magnum opus* was not available when, in the *Geographical Journal* for August 1931, the scope and contents of his various regional works were indicated. Part 5 of the 'Vergleichende Landschaftskunde,' dealing with man in the tropical zone, has appeared after an interval of six years from the publication of the preceding part which discussed and briefly described the natural regions of the same area. It represents therefore the mature development of Professor Passarge's method and is based upon a rather overwhelming mass of material drawn from published scientific studies, the narratives of travellers, and personal observations extending into four continents.

The central questions with which this volume deals are: How have the tropical parts of the world influenced man? and how have human activities modified these areas? To answer these questions Professor Passarge in the first instance divides the topics into five groups of regions: (1) The "dry" regions, (2) the wood- and shrub-lands of the "Mediterranean" type, (3) the subtropical wood- and steppe-lands, (4) the tropical steppe-lands, and (5) the tropical forests. In the second place, he shows that the interactions between man and his environment depend largely upon the stage of development, and particularly upon the type of economic community. Consequently he divides mankind, not according to races or political groups, but into such categories as the hunters and gatherers, the cattle rearers, the fishers, the tillers, the craftsmen, etc., and considers these separately in each of the types of environment.

Thus in the section entitled "Der Mensch in den Trockengebieten" he classifies the various arid and semi-arid areas not, as in Heft 4 of the 'Vergleichende Landschaftskunde,' on a purely natural basis, but according to their influence on man, *i.e.* according to their character as inhospitable or even inimical deserts, as poor or periodic pasture lands, and as oases of varying origin

and fertility; in this way the "dry" regions are divided into ten types demarcated and briefly described in terms of these characters.

Each of these types is then considered in relation to the particular human groups which inhabit or utilize them; thus the oases of the various deserts of the world are compared, the conditions of their water supply are stated, the ways in which they are utilized are noted, and their effects upon the development of their occupants are examined. Included in this examination are the customs, characters, and even the religious ideas of the peoples; *e.g.* the accounts of the Badawin given by various travellers are compared in order to give an adequate idea of their mental attributes, and in connection with the effect of geographical factors on religious development Professor Passarge utilized the conclusions reached in his book, 'Das Judentum als landschaftskundlich-ethnographisches Problem' (München, 1929).

By a differentiation between the various types of regions on the one hand and between the various cultural groups on the other, a systematic and thorough treatment is secured, but the "permutations and combinations" of regions and communities are numerous and tend to be somewhat bewildering. It is probably due to the inherent complexity of the subject that one has some difficulty in seeing the wood for the trees, but certainly Professor Passarge presents a wealth of material and an abundance of valuable suggestion to the geographer who is not anxious for small profits and quick returns. J. F. U.

HANDBOOK OF ETHNOGRAPHY. By JAMES G. LEYBURN. *Yale University Press (London: Humphrey Milford)* 1931. 9×6 *inches;* viii+326 *pages; maps.* 22*s* 6*d*

We may endorse the statement in the preface of this book that "It is not to be assumed that accuracy or completeness has been attained herein." There are, on a quick inspection, errors which would have been avoided if modern authorities had been consulted. Aimol is not in the Naga Hills but in Manipur. Lushai does not mean head cutter. Mincopi is identified with the phrase Mongebe=I am an Onge. Bhotiyas are not in China. The Shans are now in Burma. The Brahmans have ten important divisions in territorial groupings which are eminently worthy of note. India has 350 millions of inhabitants, over 2000 castes, and the allotment is about 300 entries. The maps are on small scale and rather crowded. When the errors have been corrected and a greater degree of completeness attained, a work on these lines would be useful in many ways to the layman. T. C. H.

ECONOMIC AND HISTORICAL GEOGRAPHY

THE ENGLISH ADVENTURERS. By CLENNELL WILKINSON. *London: Longmans, Green & Co.* 1931. 7×5 *inches;* viii+178 *pages.* 3*s* 6*d*

Mr. Wilkinson has added to the English Heritage Series a very well-written essay which must have been enormously difficult to plan. He discusses the difficulty in his opening pages, the difficulty of defining "adventurer." His own definition is not perfect, for it would exclude Anson, whom nevertheless he feels constrained to include. Another difficulty in running swiftly over 1 great subject is that of statement. The treatment requires the writer to keep moving; he may not stop to argue or qualify, and so he occasionally states things which are open to objection. That is an inevitable drawback to compressing a quart of history into a pint pot. Mr. Wilkinson's exceptionable statements do not seem to be numerous, but there are two which might be modified in a new edition. One is that the Elizabethans did not understand the importance of fresh food as a preventive of scurvy. There

is plenty of evidence to show that they did; their difficulty was to procure the fresh food on long voyages. The other is that Cook supposed Tasmania to be part of the Australian mainland. Surely he inclined to the belief that it was not. These are but minor criticisms of a most entertaining work. J. A. W.

ALLGEMEINE VERKEHRSGEOGRAPHIE. By KURT HASSERT. Vol. II. *Berlin: Walter de Gruyter & Co.* 1931. 9×6 *inches;* 376 *pages.* *M.*12.50

This is the second volume of the second edition of this work, the first volume of which was reviewed in the *Geographical Journal* for June 1931. This volume deals with Sea Transport (Part III), Air Transport (Part IV), and Communications (Part V). A strong historical sense permeates the whole, especially Parts III and V. Part III is naturally the longest part, accounting for about two-thirds of the volume. It is a valuable summary of a great range of literature, but lacks the freshness and originality of the other two parts. In places whole paragraphs are merely a paraphrase of other authors, acknowledged in the text. The chapter on the World Seas expresses conceptions strongly reminiscent of Mackinder's 'Democratic Ideals and Reality,' though, since there is no reference to Mackinder in either the text or the bibliography, it would seem that they have been arrived at independently. In this Part the author is at his best in two chapters on the Suez and the Panama Canals. Greater emphasis might have been laid on North America's present opportunity to dominate world shipping as she already dominates world production of so many commodities; but the general perspective is admirable. Here too, for the first time, we find an adequate attempt to appraise the spheres of the two great oceanic canals and their relation to each other. An English reader is impressed by the impartial and reasonable treatment of the effects of the war.

Part IV is rather general in scope, treating more of the development, geographical bases, and future economic results of air traffic than the details of existing air routes. In Part V such topics as commercial languages, postal services, telegraphs, submarine cables, and wireless communications are dealt with adequately and interestingly. A Briton may object to the picture of England as a gigantic spider sitting in the midst of her world cable net, but, if the simile is somewhat odious, it is true that England till very recent years had an almost complete monopoly in inter-continental submarine cables, from which she reaped much profit, both commercial and political.

Maps, diagrams, and statistical tables are few. The index and extensive bibliography cover both volumes. R. O. B.

THE CORRIDORS OF TIME. VI. The Way of the Sea (1929). VII. Merchant Venturers in Bronze (1931). By HAROLD PEAKE and HERBERT JOHN FLEURE. *Oxford: Clarendon Press.* 8×6 *inches;* viii+168 *pages each; illustrations and maps.* 5*s each*

In 'The Way of the Sea' the leading theme is the influence of the Eastern Mediterranean on Western Europe. It was from this source, and not from Africa, in the authors' opinion, that Spain received the first elements of civilization which spread thence through France to the British Isles, to Italy and Central Europe, where it came in contact with the Danubian civilization. The Megalithic and Beaker cultures attract particular attention. Receiving its inspiration from the East the former passed from the Iberian Peninsula to Brittany, the British Isles, and the Western Baltic. The Beaker culture did not originate, in the authors' opinion, in Spain, as has generally been held, but in Central Europe, whence it spread to Spain, the Rhine Basin, and the British Isles. The two cultures were therefore not of common origin, but must be regarded as for the most part

separate. This is apparent in the British Isles, where however there is a certain amount of overlapping. The importance of Hissarlik II and Crete as trading centres, largely due to their geographical situation, is insisted upon. This was especially so with Hissarlik II, in no small part due to the fact that its inhabitants discovered how to make bronze, a discovery they kept secret, thus giving them a predominant influence over the trade of the Danubian region and the West. This continued until the destruction of the city *c.* 1900 B.C., after which it passed to Crete. Recent events in Mesopotamia, Egypt, Asia Minor, and the Far East are then briefly sketched.

The leading subject of the second volume noticed is the Bronze Age in Western and Central Europe, and in the Aegean. A chapter is given to Carnac and Stonehenge, which are held to show that the development of the Megalithic culture continued into the Bronze Age, and the opinion is expressed that the Stone Circle is the most important type of prehistoric monument in Great Britain. The Bronze Age in the Aegean gives the opportunity for a brief account of the fascinating civilization of Crete and Mycenaean Greece. Finally we return to Egypt of the Empire under Thutmose III and Amenhotep III, only to watch its collapse under the latter's successor, one of the most interesting figures in history—Ikhnaton.

It will be seen that these little books cover a great range, which entails extreme condensation, and in consequence, notwithstanding the lucidity with which they are written, they may in parts be difficult to follow except for those who already have some knowledge of the subjects. The exposition also suffers from the serial or piecemeal method of treatment, causing constant breaks in continuity, and the necessity of frequent reference to previous volumes. They are admirably produced, very well printed and illustrated. E. A. P.

THE TRAVELS OF MARCO POLO. Translated into English from the text of L. F. BENEDETTO, by ALDO RICCI. With an Introduction and Index by Sir E. DENISON ROSS. (Broadway Travellers.) *London: George Routledge & Sons* 1931. 9×6 *inches;* xviii+438 *pages; illustrations and maps.* 21*s*

In his notable work entitled 'Il Milione di Marco Polo,' published in 1928, Professor L. F. Benedetto presented a carefully edited edition of the manuscript Fr. 1116 preserved in the Bibliothèque Nationale in Paris (generally known as the Geographic Text), after collating it with the principal other extant texts, accompanied by voluminous footnotes containing additions and variant readings found in the MSS. He subsequently made an Italian translation of this text, embodying such additional matter as he considered of importance from other texts. In preparing this translation he has frequently, it appears, had recourse to readings in the FG Group (the basis of Pauthier's and Yule's versions) not noted in his previous work. The present work, we are told, "represents in the main the English translation of his Modern Italian version made by the late Signor Aldo Ricci, whose untimely death occurred shortly after he had completed it." It appears however that certain differences will be found between Professor Benedetto's Italian version and the English translation now before us. "This is especially the case," Sir E. D. Ross writes, "in regard to obvious errors in matters of fact, for whereas Professor Benedetto has corrected these in his translation with a view to accuracy in the narrative, I have persuaded him to allow me in such cases to adhere to the original readings, however faulty, with a view to accuracy in the text." A few examples follow to show what is meant. We think it would have been better to have noted all such alterations made in Professor Ricci's work at the foot of the page on which they occur, so that the reader might at least have the benefit of knowing what emendations Professor Benedetto's vast

researches and probably unique acquaintance with the literature had suggested. Many passages will be found in this volume which do not appear in Pauthier's and Yule's text or in the Geographic Text. These have been included by Professor Benedetto in his modern Italian version from other MSS., such as L, Z, and R. It would have been an improvement perhaps if the sources from which these additions were derived had been indicated in footnotes. It would be interesting to know on what authority the "country called Taican" had been substituted for the "country called Dogana," to which we have hitherto been accustomed, in the section on the city of Balkh.

The present edition of the Travels will be welcome to the general reader who has not made a critical study of Polo's narrative. The index, which has been admirably compiled with the aid of Miss Stella Buchanan, will help such readers to identify names of places and persons that appear in unfamiliar or even unrecognizable form, and serve as a glossary in respect of many Oriental terms used. This index seems very complete as regards names of places and people, but a few omissions are noticed in the case of other words, *e.g. mulehet*, *kemis*, *grosso*. "Choreha," on p. 109, should read "Chorcha," apparently. Kāyal (Polo's Cail), once a famous port, is not Tinnevelly (Index, p. 415). C. E. A. W. O.

GENERAL

IN THE TRACK OF THE CRUSADERS. By EVERT BARGER. *London: Nash and Grayson* 1931. 9×6 *inches;* 282 *pages; illustrations and sketch-map.* 15*s*

This book is an account of a journey from Vienna, through South-Eastern Europe, Asia Minor, and Syria, to Jerusalem. As it was accomplished with a minimum of expense, it is a record of transport at its cheapest, with lodgings to match, and therefore shows more of the everyday life of the peoples than do most modern travel books dealing with these regions. The writer has historical rather than geographical interests, but his descriptions are the results of careful observation, and although he frequently recalls the past he gives very interesting accounts of present conditions in this group of countries which have suffered such great changes since, and because of, the war.

The lands traversed are at this time in a state of rapid transition, books of only a few years back are already out of date; and the present trends of development are of great importance in world politics. From this point of view the descriptions of the attempt to westernize Anatolia, with its curiously mixed consequences, are of particular significance, while the account of the riots in Jerusalem in 1929, in which the author chanced to be involved, brings out more than one aspect of the racial clash in Palestine.

The book may thus contribute to an understanding of countries of great interest at the present time, and may be commended to those who would like to gain an idea of places and peoples in the Near East without suffering the discomforts which the author so naïvely relates. J. F. U.

MEMOIRS OF A SOLDIER OF FORTUNE. By General RAFAEL DE NOGALES. *London: Wright and Brown* [1931]. 9×6 *inches;* xvi+334 *pages; illustrations.* 21*s*

This is not a work of particular geographical importance though it contains vivid word-pictures of the frozen wilderness of Alaska where the mercury approaches the danger line of "eighty below" and prospectors fear the freezing of their lungs; of the burning stony ravines in the Sierra that rises from the Chihuahua desert of Mexico; and of the Llanos or pampas of rolling grass which constitute the vast cow ranches of Venezuela and are characterized by intense heat, tropical

floods, and the presence of many noisome forms of beast, reptile, fish, and insect. It tells also of the Columbian–Venezuelan frontier of mountain, river, and wild Indian territory; of the Carribean Sea when its waters are lashed into fury by tornado or cyclone; and of the stricken country of Armenia as it was seen in June 1915 after the massacres of the War, witnessed by the author. His book is one of stirring adventure, told for the most part lightheartedly; of thrilling accounts of cattle-thieving on a large scale, reminiscent of "Robbery under Arms"; of gold mining and "looking for copper in a silver mine for the purpose of issuing paper"; of hunting in the forests and on the rivers of four continents; of gun-running across land and sea frontiers; of fighting in camp rows, in revolutionary risings, in wars small and great.

Rafael de Nogales is a Venezuelan, now some fifty years of age, who became a soldier of fortune rather than agree with or submit to the régime of Castro or Gomez, successive presidents of Venezuela. The synopsis at the beginning of the book foretells his either being president himself, or winding up "with his back to the wall and a cigarette between his lips directing the fire of the squad that is to shoot him." Mr. Cunninghame Graham, who writes the preface, says of the Memoirs that "few books of the kind ring with such sincerity as this, penned by a d'Artagnan of the Twentieth Century." It may be thought by some readers that they suffer from the defects of the qualities of Dumas's Gascon hero.

The effect of the word-pictures in the book is not enhanced by the photographs with which it is illustrated. They seem to have got into it by mistake as they have no connection with the letterpress on the pages opposite to which they are placed and little with the subject-matter of the book. This bears other evidence of having been hastily and rather untidily put together. M. N.

THE WANDER YEARS: Hunting and Travel in Four Continents. By FREDERICK LORT-PHILLIPS (FREDERICK GILLETT). *London: Nash and Grayson* 1931. 9×6 *inches; 314 pages; illustrations.* 21*s*

This book, as its title suggests, is a description of hunting and shooting expeditions in various places more or less well known to travellers and sportsmen. The expeditions, thirteen in number, extend over sixteen years, from 1892 to 1908, and in the interests of exploration and geographical research it would probably have been better had Mr. Lort-Phillips's book appeared twenty years ago. As it is, most, if not all, of the localities with which he deals have been the scene of other expeditions since he visited them.

Mr. Phillips takes the matter for his book from a series of diaries made at the time and carefully preserved. These show him to have been indefatigable in his search for fresh fields to conquer and specimens to acquire: a good shot and fisherman, and ready to face with courage and resource any situation that might arise in the course of his roamings in wild regions. It might occur to the reader however that sometimes the uncomfortable position in which he and his companions found themselves might have been avoided by the exercise of more discretion: for instance, the rather exciting experience with the Abyssinian chief related in Chapter IV.

Mr. Phillips's account of the demonstrations and "shillooks" (this word does not mean "loot," by the way) which followed on the murder of Nasr-ud-Din Shah, and the "gatching" of some comparatively innocent persons by the pusillanimous Governor of Shiraz is vivid and interesting. He was probably lucky to have made the journey from Shiraz to Teheran at that particular time without suffering injury or at least grave personal inconvenience. The various shooting expeditions are well described, and the photographs admirable and well chosen. An agreeable and readable book. W. G. G.

THE MONTHLY RECORD

THE PROPOSED NORTHUMBERLAND NATIONAL PARK

It will be recalled (*G.J.*, vol. 77, p. 176) that in his recent book on 'National Parks' Dr. Vaughan Cornish suggests one site amid the Northumbrian moors comprising a section of Hadrian's Wall. He has lately issued a pamphlet (London: Sifton, Praed & Co.) based on a paper read before the British Association, designed to maintain public interest in the proposal until such time as legislation becomes possible. In this pamphlet Dr. Cornish makes certain proposals for the character and extent of the Park as well as for preserving the amenities of the district until the scheme should be realized. The part to be enshrined as a National Park is to be about 9 miles long and 5 broad, with the Roman Camp at Housesteads, a little north-east of Haltwhistle, as its middle point. Here Hadrian's Wall is carried over the volcanic crags of the Great Whin Sill, and it is recommended that the project would give the public easier access to this great historic monument set amid such wild and picturesque scenery. Dr. Cornish points out that the crags of the Whin Sill strike an attitude singularly appropriate to their historic situation, "thrusting their forbidding front northward against the land of the Pictish tribes." In this connection it may be added that farther north-east in Northumberland, where a gap in the Whin Sill occurs, the line of crags is taken up by the outcrop of the Fell Sandstone, giving rise at Rothbury to the splendid moors and scarps of the Simonside Hills, which likewise face the Cheviot Hills and Scotland.

GLACIATION IN THE NORTH SEA REGION

Dr. J. Kaye Charlesworth, Professor of Geology in Queen's University, Belfast, contributes to the *Proceedings of the Royal Irish Academy* (vol. xl, sect. B, no. 4) a paper entitled "A Tentative Reconstruction of the Successive Margins of the Quaternary Ice-Sheets in the Region of the North Sea." His purpose is to rectify for the region in question what is represented by Dr. E. Antevs in a valuable series of maps showing the extent and distribution of the Quaternary ice-sheets and glaciers in different parts of the world. Dr. Charlesworth's conclusions are embodied in an outline map of North-West Europe showing the successive positions of the ice-margins on either side of the North Sea. The oldest glacial drifts in Britain whose southern composite margin lies a little north of the Thames and trends north-eastward through Essex to the coast correspond with what is known as the Elster and Saale glaciations of Germany and Holland. At this period the English and Continental ice-sheets were joined, forming a cusp-shaped margin in the southern part of the North Sea which was then filled to the bottom with solid ice. The newer British drifts, whose southern margin lies farther north, a little south of the great Cromer moraine, were contemporaneous with the Warthe and Brandenburg moraines on the Continent, but at this period the British and Continental ice-sheets were independent, the former having its margin trending from north to south halfway across the North Sea, and the latter its margin close to the Norwegian coast. Thus at this time the British ice formed a piedmont mass over the western part of the North Sea, and its deflection to north and south from the mouths of the Tay and Forth was due to fanning and the counter pressure of shelf-ice in the North Sea fed by snow blown from the mountains of Norway and Scotland. Lastly, when this ice had all passed away, there was highland glaciation of a local character in Scotland, Ireland, and Northern England corresponding in time with a similar development of glaciers in Scandinavia.

Dr. Charlesworth, recognizing the uncertainty of the subject due to our imperfect knowledge of the contours of the sea-floor and the inaccessibility of the drifts beneath the sea, does not claim that his conclusions are anything more than provisional; but we agree with him in holding that the attempt at such a reconstruction is worth while in narrowing down the issue and forming a useful standard of reference for glaciologists.

CHANGES IN THE PO DELTA

Over thirty years ago Professor G. Marinelli made a careful study of the growth of the Po delta during the nineteenth century, and his results were summarized in the *Journal*, vol. 12, p. 187. The systematic observations made since 1900 by the Italian Hydrographic Office, particularly the Department known as the Ufficio del Po, have made it possible to take stock of the changes during the past thirty years, as is done by Sig. M. Visentini in *Bulletin* 16 of the Section d'Hydrologie Scientifique of the International Research Council. The latest survey of the outer margin of the delta, compared with that of 1900, shows that the changes have differed considerably at the different mouths, an actual retreat of the shore having been revealed at the Maestra and Goro mouths, while the others show advances averaging from 11 to over 40 metres annually. The most noteworthy is at the main mouth known as the Po della Pila, where the division into three channels, foreshadowed in 1900, has now become well established, and at the southernmost of these the average yearly advance has been 46 metres. The different conditions at the different mouths are evidently linked with the variations in the discharge, the Po di Pila having of late years taken a much larger percentage of the total—about 70 per cent. at low water, and 61 per cent. in flood—than previously. The discharge by the Maestra mouth, which had been 5 per cent. of the whole at high water in 1900, had fallen to 2 per cent. in 1928. Observations of the amount of matter carried in suspension by the river have lately been made with great care, and show that on the whole it has been less than has been supposed. The mean yearly amount works out at 12,000,000 cubic metres, though it differs enormously from year to year. The changes of the coastline during the past thirty years seem also to have been less than the estimates previously made for longer periods. The probable reason for the present slower advance would seem to be that the main mouth is now more exposed to the action of the marine current, which hinders the deposition of the sediment.

ALUMINIUM RESOURCES OF ITALY

The constantly increasing use of aluminium for purposes where combined strength and lightness are important, from aeroplanes to household utensils, has led to a widespread search for sources capable of being developed economically. It has been pointed out that the use of electricity in its production places Italy in a particularly favourable position by reason of its abundant stores of hydro-electric power, and much attention is being given to the resources of the country in aluminous minerals. In the *Bollettino* of the Royal Italian Geographical Society for August–September 1931 Sig. P. Gribaudi takes careful stock of such resources, with special reference to the deposits of bauxite as the mineral offering greatest facilities for economic production of aluminium. The figures given at the outset for the world's production since the war present a striking picture of rapid increase during the past decade. The production of the United States, which leads by a long way, rose from 90,000 tons in 1920 to over 100,000 tons in 1929, but the proportional increase in other countries was far greater, the output of Germany, France, Canada, Switzerland, and Norway, which in 1920 varied between 6000 and 16,000 tons, having approached or even exceeded 30,000 in

1929. Italy's increase, from 1238 to 7500 tons, was at a still higher rate. Of the markedly aluminous minerals, Italy's volcanic regions possess stores of leucite, but the extraction of aluminium therefrom is unprofitable unless combined with some other chemical industry such as the production of potash or caustic soda. Important developments in this direction are however looked forward to. But the material of prime importance for aluminium production is at present bauxite, the output of which has more than tripled since 1913, the chief producing countries being France, the United States, Dutch and British Guiana, and Italy. It occurs chiefly in limestones of cretaceous age, principally in cavities of lenticular form, and its composition varies according to the distance from the walls of the cavity. To offer the most profitable results it should contain not less than 50 per cent. of alumina, and not more than $4\frac{1}{2}$ per cent. of silica and 10 per cent. of ferric oxide. The chief Italian deposits are in the limestone ranges of Istria, the Abruzzi, and Apulia, and Sig. Gribaudi discusses the conditions and prospects of each in turn. Bauxite was found in the Abruzzi as far back as 1857, but an unfortunate error in labelling a specimen led to the belief that its locality was Calabria, this delaying for many years the practical outcome of the discovery. There are extensive and promising deposits also in the south-eastern peninsula (the "heel" of Italy), but the richest are in Istria, where they are widely scattered though found principally in a zone running across the centre of the peninsula from north-west to south-east. They occur either in the form of nests or pockets or mixed with red earth, that of a brownish-red colour and amorphous structure being the commonest type. In 1928 the total production in Istria reached 138,000 tons, as against 10,000 in the Abruzzi and Campania.

THE MOUNTAINS AROUND TATSIENLU

The positions and heights of the mountains around Tatsienlu were discussed in the *Journal* for April 1930 in the light of the evidence supplied by travellers' accounts and by Mr. Herbert Stevens's sketches. This region has recently been visited by an expedition from the Sun Yat Sen University, Canton, and the leader, Arnold Heim, gives a preliminary sketch of its work in the *Zeitschrift* of the Berlin Geographical Society, Hf. 7–8, 1931. Tatsienlu was reached from Ningyuan, and much time was spent in examining the surrounding mountains. The data from which the heights were calculated will be published later, but a few preliminary figures are given. Professor Imhof, who was responsible for this work, concludes that the peak Jara, whose height was given by Lieut. Kreitner, of the Szechenyi expedition, as 7800 metres, cannot exceed 6000 metres. On the other hand, Kreitner's height of 7600 metres for Kunka (or Minya Gonka, as Heim refers to it) is supported by Imhof's figure of "approximately 7500 metres." No details of the methods of determining the heights are given. It will be remembered that the general conclusion of the paper in the *Journal* was that probably none of the peaks in this region exceeded 25,000 feet. The illustrations include a photograph of Minya Gonka from the west, which may be compared with Mr. Stevens's sketch No. 3. The party was held up in this neighbourhood by bad weather for three and a half months. Minya Gonka is a young granitic peak, apparently unclimbable, with steep metamorphosed sandstone on the west flank. It stands 500–1000 metres above the rest of the range, with three great valley glaciers descending from it. It has not experienced an ice age in the general use of the term: on the eastern, moister, flank, the old and new moraines are in the relation of the historical to the modern Swiss glaciers. This may be due to no considerable variation in the precipitation from the summer monsoon, to a recent quaternary upheaval of the mountains, or to a combination of both.

Between 30 November 1930 and 31 January 1931 the party travelled from Tatsienlu westwards to Litang, and thence northwards through the Niarong country by previously untraversed ways to Rino, the chief settlement. The slopes of those highlands exposed to the sun are normally free from snow in the winter, so that melting snows can contribute little to the summer rise of the Yangtze. On their return they examined north-west of Tatsienlu the traces of the severe earthquake of March 1923. Here they encountered Mr. J. H. Edgar, who had recently made the first find in this district of palaeolithic stone implements in the loess at a height of 3000 metres. The full results will not be published for some time, as they demand much working out.

A journey into another little-known mountainous area south-west of the Minya Gonka range is described by Mr. J. F. Rock in the *National Geographic Magazine*, July 1931. Mr. Rock reached Likiang by Yunnan-fu and Talifu. There he established relations with the king of Muli, a semi-independent area, ten days' journey northwards. To the north and north-west of Muli lies Konkaling, the mountainous district intersected by the deep gorges of the left-bank tributaries of the Upper Yangtze. Konkaling is almost completely isolated at present by robber bands, following upon the decay of Chinese authority, but Mr. Rock, through the king of Muli, obtained a safe conduct for his party to progress around its sacred peaks, the chief of which is 'Konka Risumgongba.' Striking west and north-west from Muli, the party went round the slopes of Mitzuga mountain, a 16,000-foot crenelated range covered in spruce, oak, and rhododendron, to the gorge of the Shu Chu, beyond and 10,000 feet above which rise the Konkaling mountains. The high temperatures experienced in the valley were an uncomfortable contrast to those of the cool, forested ranges. The way out of the valley leads up the steep side from terrace to terrace on which hamlets perch. The latter part of the route lay along the valley of the Konka Chu, a tributary of the Shu Chu which descends from a glacier in the Konkaling group. On a 16,000-foot spur beyond Guru, Mr. Rock obtained a good view of the Minya Gonka range, 200 miles distant. The journey round the Konkaling range, described as a "most peculiar mountain mass, . . . three isolated peaks rising from a triangular plateau," was very arduous, as severe storms were encountered and the trail was rough. The highest peak is estimated to be over 20,000 feet. Mr. Rock made two attempts to revisit Konkaling, but was prevented by bandits.

SALT LAKES IN EAST AFRICA

Since their first discovery by German explorers before the end of last century the salt lakes of the rift zone in the north of Tanganyika Territory have been studied with some care, special attention having been given to Lakes Magadi and Natron by Uhlig, Scholz, Obst, Jaeger, and others. Some of the less known of these lakes were examined in 1929 by Mr. Orr and Dr. Grantham, of the Geological Survey of the Territory, whose report was issued last year as *Short Paper No.* 8 of the Survey. The lakes vary greatly in size, the largest—Eyasi, more correctly known as Nyarasa—having an area of some 400 square miles, and to this and to the smaller lake Balangda, the chief attention is given. Each lies at the south-east foot of one of the striking rift-scarps which run from south-west to north-east through this part of the country, and each is also associated with a great volcanic peak—Eyasi being blocked to the north by Oldeani (10,000 feet), while Hanang (11,150 feet) rises on the south-east side of Balangda. The bed of the latter was quite dry when visited in October, apart from a few small swampy areas, but at the north and south ends the clay-loam of the bed was covered with a thick salt crust of dazzling whiteness, due to continued high evaporation in an undrained basin. The deposits when analysed proved to be

essentially alkaline, the main constituents being sodium chloride, sodium carbonate and bicarbonate, and sodium sulphate. (It is noted that the same constituents are present in much the same proportions in Owen's Lake, California.) As springs of fairly good drinking water occur near the shores the annual regeneration of the deposits must be small, but it is calculated that accumulation during a long period has produced some 500,000 tons of the various salts, about half being sodium chloride. They therefore possess considerable value, and the conditions for exploitation seem on the whole good.

The depression of Eyasi seems to have owed its origin to what has been called "trap-door faulting" on a large scale, the down-throw on the north-west side being about 3000 feet. At the south-east end, examined by Mr. Orr, there were concentrated brine-pools along the course of the Sibiti river, which formed a channel in the otherwise dry lake-bed. Fairly pure common salt crystallizes from these and is carried away by the natives, and this would seem the only supply capable of commercial exploitation in this part of the basin. The rest of the lake floor was examined by Dr. Grantham, who found that by far the greater part was covered with a thin sandy crust containing from 10 to 40 per cent. of salt and alkali carbonates. Many samples were taken and analysed, and the report treats in turn of the specially saline areas, with an attempted estimate of the total supply of salts present in the lake, deduced however from observation of a thin surface layer only. The floor is exceedingly flat and the salt streaks and channels are probably not permanent—a fact to be reckoned with in any attempt at exploitation. The origin of the salts in Eyasi is generally similar to that spoken of in connection with Balangda, though the main source of the alkali carbonates is probably the volcanic area at the north-east end.

ADIRONDACK DRAINAGE SYSTEM

On the basis of field-work by himself and other geologists, Mr. R. Ruedemann publishes in the *American Journal of Science* (November 1931) a study of "The Tangential Master Streams of the Adirondack Drainage," which offer an interesting problem in river development. The pre-Cambrian dome of the Adirondack massif shows a peculiar marginal drainage, for the lesser streams that originate within the massif and flow out radially in all directions are received on reaching its margin into four main arteries which have a tangential instead of a radial direction. They are the St. Lawrence in the north, the Black river in the west, the Mohawk in the south, and Lake Champlain (Richelieu river) and the Hudson in the east. As a rule they hug the base of the escarpments of the cuestas that surround the central massif, and are well preserved on the south and south-west, while represented by slighter indications elsewhere. The massif was once largely covered by the Palaeozoic formations which now form the cuestas, and the drainage was radial in direction. The original Susquehanna drainage, which even now starts from the northern edge of the southern cuesta, must have reached well up on to the Adirondack plateau, passing at right angles to, and above, the present site of the Mohawk. Similarly, the pre-glacial stream whose basin is now Lake Ontario, reached up on to the plateau across the present Black river course. The present river-system was developed by stream-piracy, following the removal of the Palaeozoic strata from its centre in Mesozoic time and the gradual formation of a ring of cuestas on the slope of the harder rocks beneath. The streams with steepest grades and greatest erosive power sent out side branches on the inside of the cuestas, and these captured the neighbouring streams; thus the Mohawk branch of the Hudson captured the head waters of the Susquehanna, the Black river those of the Ontario rivers, and so on. The original circular rim was breached at the four corners, otherwise the massif would

still be girdled by a series of lakes formed at the close of the glacial period, as the Canadian and Fenno-Scandian shields are to-day. Such lakes may well be termed glint lakes from the Scandinavian term for the surrounding Palaeozoic escarpment.

OLD KENTUCKY DOCUMENTS

The first detailed map of Kentucky, the work of the early pioneer John Filson, was published at Philadelphia in 1784 to illustrate Filson's brief account of that region, and it has been much sought after by reason of its scarceness, though originally issued in some numbers, both with the book and separately. Apparently there was a keen demand for information about the new country, and this encouraged one Alexander Fitzroy, of whom nothing further appears to be known, to bring out in London in 1786, under his own name as author, what is virtually but a condensed version of Filson—an instance of literary piracy which it would be hard to beat. This has become even rarer than Filson's book or map, only two copies having been traced so far, both in American libraries. It was last year reprinted in facsimile by Dr. W. R. Jillson, State Geologist of Kentucky, in a tastefully got-up booklet of which a copy has been presented to our Library. (Dr. Jillson had previously done the same for Filson's book, issued as Publication No. 35 of the Filson Club.) The booklet begins with a vivid summary of the stirring events connected with the first opening up of Kentucky, in which Filson, with Boone and others, played a prominent part. It also supplies an excellent reproduction of Filson's map, from a copy lately found by Mr. R. C. B. Thruston, which differs in some details from that in the Library of Congress, reproduced by Mr. Lee Phillips in 1908. Lastly, there is a letter from Colonel Martin, the present head of the map collection in the Library of Congress, putting forward the view that not only was Filson's book pirated by Fitzroy, but that his map also was re-issued with the latter's pamphlet, which contains references to an annexed map. It is even hinted that two of the known copies of Filson's map (the number of which has now reached a dozen) may represent Fitzroy's issue, since they are on paper with Whatman's watermark, while the copies in Filson's own book bear a mark supposed to be that of an American maker, a plough with the motto "Work and be rich" and the letters PPD. Colonel Martin thinks that the dozen known copies may represent six to eight different printings.

THE GEOGRAPHY OF DANIEL DEFOE

In a paper with the above title contributed to the *Scottish Geographical Magazine*, September 1931, Mr. J. N. L. Baker demonstrates the probable sources of the geographical matter in Defoe's works, and discusses them as evidence of the geographical knowledge of a well-informed man of his period. The extent to which he mixed fact and fancy is shown in his work 'The Storm,' which dealt with the great storm of November 1703. Much of the evidence published, which had been received from correspondents, was worthless, but the book is prefaced by a letter from William Derham, afterwards printed in the *Philosophical Transactions* of the Royal Society, which was a serious effort to explain the phenomena observed. The first chapter is also largely based upon R. Bohun's 'Discourse concerning the origine and properties of wind,' 1671. Defoe then discusses the opinion of the ancients that Britain was particularly subject to storms, pointing out that storms would appear much more violent to navigators in the fragile vessels of past days. He considers that the reclamation of fen and marshland and the training of rivers must have greatly decreased "the multitude of exhalations" and thus the rainfall, but calls in no change of climate.

'The further adventures of Robinson Crusoe' contains a narrative of a journey

from Pekin to Archangel, Defoe obtaining his "local colour" from Avril's 'Voyage en divers estats . . .' and Ogilby's translation of Nieuhoff's 'China.' The other two instances discussed show what may almost be considered a forecast of future exploration. The 'Life of Captain Singleton' includes a journey across Africa from the mouth of the "Quilloa" to the Gold Coast. Mr. Baker reconstructs this imaginary journey on a contemporary map by Moll, indicating the portions based upon current knowledge. 'The New Voyage round the World,' 1725, draws upon the accounts of Woodes Rogers, Narborough, and Dampier. The writer takes his voyagers round the Cape of Good Hope to the Ladrones, and then discusses the prospects of exploration in the North and South Pacific. Finally, he sends them southwards to discover lands from 17° to 50° S., one of which would afford a good outlet for woollen goods. Defoe claims that had he continued southwards after his first "discovery" he would have made more important finds: as Mr. Baker remarks, he would have "discovered" the east coast of Australia.

OBITUARY

COLONEL MILO TALBOT

Colonel the Hon. Milo G. Talbot, C.B., who died on 3 September 1931 at Bifrons, near Canterbury, had been a Fellow of our Society for forty-four years, and during that period, and before, had contributed much to our knowledge of the topography of the North-West Frontier region of India, and of the Anglo-Egyptian Sudan. He was the fourth son of the fourth Lord Talbot de Malahide, and was born in 1854, being thus seventy-seven years of age at the time of his death. He was educated at Wellington and the R.M. Academy, Woolwich, and joined the Royal Engineers in 1873. He saw service in the Jowaki Afridi Expedition of 1877–78; in the Afghan War of 1879–80; in the Mahsud Waziri Expedition of 1881; and was D.A.A.G. in the Nile Expedition of 1897–99. He was also employed on special service in the Great War.

He had exceptional experience of frontier surveys and of surveys on active service, and this he owed originally to having been selected for duty on the Survey of India. When Sir Robert Sandeman conducted his political mission in 1883 through South-West Baluchistan to Gwadur on the Persian Gulf, Colonel Talbot accompanied him, but returned to India by another route. He was able, during this expedition, to carry out a series of chains of topographical triangulation, based on the Indian triangulation. He turned north from Panjgur and, with the assistance of Lieut. Wahab, rapidly surveyed a huge desert region adjoining the Persian frontier. Lord Aberdare, in his Presidential address of May 1884, remarked that the result of this seven months' tour, over those alternately scorching and freezing highlands, was an enormous out-turn of topography.

Another President, Major Leonard Darwin, when presenting the Patron's Medal to Colonel Talbot, in May 1909, said that the most noteworthy feature of his work was the mapping of very extensive areas, under trying conditions, always with a high ideal of accuracy. In 1884–86, when a member of the Afghan Boundary Commission, he, single-handed, carried a trigonometrical chain from Mashad to the Hindu Kush, and he became the leading authority on the country lying between Kabul and Herat. In 1900 he was appointed the Director of Sudan Surveys, a post which he retained until his retirement in 1905. In this field he carried out some of his most important work. But it was not a new field to him,

for already in 1893 he had fixed the position of Halfa by telegraph, and the same year had accompanied a patrol into the desert and had fixed the position of certain wells. In the following year we find him carrying out surveys at Suakin, and in 1896 he carried a triangulation with the advance of the army as far as Dongola, and during the two years 1897–98 continued to fix positions southward along the Nile Valley. In 1899 he determined the position of Omdurman telegraphically, and in 1900 he delimited the Sudan–Eritrean boundary with the Italians, a base being measured at Kassala. It should also be mentioned that, during an interval in his labours in the Sudan he was in 1895 for a time in charge of the section at the War Office that afterwards became the Geographical Section, G.S.

Colonel Talbot was a man of exceptional ability, who made his mark in whatever occupation he might happen to be engaged in. He passed a brilliant course at the Staff College, and he might, had he wished, have had a distinguished career in purely military commands. An all-round man, he was a fine horseman, a good cricketer, and universally and deservedly popular with all those who worked with him. A man of great talent, and sound judgment, he could have made a name for himself in any walk of life. But he had little or no personal ambition, beyond the desire to do good service in the geographical world; and he was never happier than when he was mapping some wild country for the first time.

C. F. C.

CORRESPONDENCE

THE NEW ONE-INCH ORDNANCE MAP

The new 1-inch map has come in for a chorus of praise from the professionals. Now perhaps the amateur may be allowed to raise his voice; for to him also a new edition is an event of no little interest. It is by no means certain that the man in the street, or rather the man in the open country, is going to give this map such an enthusiastic welcome. To one at any rate, who has walked thousands of miles in these islands Ordnance map in hand or pocket and so may claim to be heard, the latest move of the Survey appears to be in a retrograde direction in some respects. In spite of all that has been said the new edition is not as clean a map as the old Popular. In making a comparison it is not fair to use the Plymouth sheet of the latter, as it is not a good specimen. The contour lines of the sheets vary considerably in colour and definition; but in some of the best examples they give as good an idea of the relief to an intelligent map-reader as is possible without layers. Genuine escarpments are shown at once by the closeness of the lines. The theory that small features occurring between the 50-foot lines do not appear does not amount to much; for who expects them to appear on a 1-inch scale unless they are crags, when they can be shown by the crag symbol? The hachures of the new map seem to add practically no helpful information. Very little idea, even with the aid of the new layering, is given of the relative heights of Caradon Hill (1213 feet), Kit Hill (1091 feet), and Green Hill on Dartmoor (1553 feet). The great objection to hachures has always been that they obscure lettering. In the new map we have not only this drawback but also a quite inadequate and apparently unsystematic layering, neutralizing the yellow of the small roads, muddying the green of the woods, and dulling the blue of the rivers which in any case is not so brilliant as in the Popular sheets. In walking across a country like Dartmoor you want to be able to see at a glance where the rivers are so as to avoid needless ups and downs, and where the tracks run so as to make rapid progress when necessary. And it must be remembered that a map has often to be consulted in wind and rain, possibly in twilight, which is a very different matter to

looking at it on the wall of the Society's Ambulatory. The Popular sheets are far more satisfactory in these circumstances than the new map can be; and it is with feelings of dismay that many will hear of their being superseded.

J. H. REYNOLDS

'SOCIAL AND ECONOMIC GEOGRAPHY'

Will you kindly allow me the courtesy of your columns to reply to certain statements as to facts and not of opinions contained in the review of 'Social and Economic Geography' in the July number of the *Geographical Journal?*

The ascription of my geographical outlook, the reference to my acknowledgments, and especially the reviewer's description of the aim of the book, are not in accordance with my specific statements in the Preface. The reviewer misquotes me with regard to my basis of regional classification, and there is no reference to "Patagonian Desert (p. 143)" in the book. My summarized statement that climate is one factor contributing to the well-being of the people of the cool temperate marginal regions is not contrary to the findings obtained for the Industrial Health Research Board, and the description of an average temperature of 70° F. in my supplementary table headed "Average Air Temperatures" ("Annual" obviously omitted) is supported by the Book of Normals.

My authorities for not marking Japan malarial are the recent statistics of the Imperial Japanese Government, the current practice of British insurance companies, and the Atlas of Economic Geography (1914 edition), whose map "Climatic Diseases" provided the basis for my map. Further, the review contains no reference to the second and larger portion of the book dealing with world trade, transport, and communications.

L. BRETTLE

MEETINGS: SESSION 1931–1932

Third Evening Meeting, 30 November 1931. The President in the Chair

Elections: Bertram Stannaford Allen; Thomas Grimbaldston Baillie, B.SC.; George Francis Cooper; John Henry Dixey; Montague Goodman; Miss Sybil Harker; Captain Edward Murray Harvey, O.B.E., M.C.; William Hawksworth; John William Johnson; Maxwell R. Kirkpatrick, M.A.; Frederick John Martin; Alexander Morgan; Frederick Lincoln Ralphs, M.SC.; Colonel William Henry Ralston, D.S.O.; J. F. Straker; T. P. Theron, B.A.; Miss Katharine Frances Wedgwood

Paper: The Bakhtiari Country. By Mr. J. V. Harrison

Second Afternoon Meeting, 7 December 1931. The President in the Chair

Paper: The Urban Population of Great Britain. By Professor C. B. Fawcett

Special Evening Meeting, 10 December 1931. The President in the Chair

Paper: The British Expedition to Greenland. By Mr. H. G. Watkins

Fourth Evening Meeting, 14 December 1931. The President in the Chair

Elections: Brig.-Gen. R. J. Cooper, C.B., C.V.O.; Walter E. Gilbert; Major George van Baerle Gillian, I.A.; Wilfred E. Hampton; Major William Peate Hogg, M.C.; Mrs. P. Balmer Lawrie; Captain J. S. Lethbridge, M.C.; James H. Martin; Mrs. Irene Roberts; Miss Freda Jessie Smith; James Huxton Telford; Miss E. M. Timberlake; Charles Noel Wilde; Dr. Edward Yeates; Professor Herrick Black

Paper: The Voyage of *Discovery II:* Surveys and Soundings. By Dr. Stanley Kemp

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